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NORTHUMBERLAND
SEA FISHERIES COMMITTEE.

1899.

Report on the Trawling Excursions,
ON THE FISHERY CONFERENCES,

AND ON THE
Observations made at the Marine Laboratory,
CULLERCOATS,

& DURING THE YEAR 1899,

BY

ALEXANDER MEEK, M.Sc., F.Z.S.

THE DURHAM COLLEGE OF SCIENCE, NEWCASTLE-UPON-TYNE.



Printed by order of the Committee, 19th October, 1899.

Newcastle-on-Tyne :

CAIL & SONS, 29 AND 31, QUAYSIDE.

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THE TRAWLING EXCURSIONS.

There is very little to say by way of preface to the report on the trawling experiments made this year along the coast of Northumberland. The general objects and conditions have been specified in previous reports. Some changes were necessary in regard to the time devoted to some of the bays, which will have to be pointed out and explained before Table 1. is compared with the similar table presented in previous reports. It ought to be mentioned, moreover, that while the length of the beam, of course, remained the same, viz., 22 feet, a new net was in operation during the first part of the season—until 26th July—when it was lost, at the end of the experiment of that date. For the remainder of the experiments, a net which was used in former years was again brought into requisition. The weather on the whole was very favourable, and was indeed above the average, as is evidenced to some extent by the records of temperature. I beg to take the opportunity of offering once more our grateful thanks to Ald. John Dent for the use of the "Livingstone," and for the help which he and everyone who took part in the experiments, so kindly gave in making up our records, which as will be seen are now greatly extended.

It has been said above that as Table 1. stands, it does not offer a fair comparison with the results of previous years, and some considerations are necessary before we institute that comparison. This may be best done perhaps by briefly reviewing the conditions under which each excursion was made.

Skate Roads was the scene of the first experiment on the 21st June. Three hauls were made of $1\frac{1}{4}$, $\frac{3}{4}$, and 1 hour respectively, giving 3 hours in all. This may be taken as about one-third of the time devoted to this bay usually. Very few fish were obtained at the first two hauls (see complete record of first haul, page 16), the majority of those recorded being got at the third haul. Such variability in the catch is not usual, but its occurrence makes it still more difficult to bring this record into line with previous experiments. It seems to show, however, that the catch for that day would have been up to the average for Skate Roads.

On the 23rd June, two days afterwards, the same ground was again trawled over for $1\frac{1}{4}$ hours (10.45 a.m. to 3 p.m.), and we only got as the table shows, 34 fish as compared with 90 fish on the first occasion. This was certainly very much below the average for Skate Roads.

TABLE I.—Showing the numbers and kinds of fish obtained at each excursion.

| PLACE. | DATE. | Turbot. | Brill. | Sole. | Plaice. | Dab. | Flounder. | Collings. | Mackerel. ^b | Gurnard. ^b | Skate. | Total. | Mid-day Temp. of Surface. | SEA. | WIND. |
|----------------------------|----------------------|---------|--------|-------|---------|------|-----------|-----------|------------------------|-----------------------|--------|--------|---------------------------|----------------|--------------|
| Skate Roads ¹ | ... 21st June, 1899. | ... | ... | ... | 75 | 5 | 10 | ... | ... | ... | ... | 90 | Degrees F. 54 | Smooth | N.E. |
| Goswick ² ... | ... 23rd " | ... | 2 | ... | 22 | 2 | 3 | ... | ... | ... | ... | 29 | 56.5 | Do. | N.E. |
| Skate Roads ³ | ... 23rd " | 1 | ... | ... | 29 | ... | 3 | ... | ... | 1 | ... | 34 | 56.5 | Do. | N.E. |
| Aldmouth Bay | ... 5th July | ... | 1 | 1 | 76 | 76 | 12 | 1 | ... | 12 | ... | 179 | 58 | Easterly swell | N.E., light. |
| Druridge Bay | ... 19th " | 1 | ... | 1 | 24 | 65 | 1 | 1 | ... | 20 | ... | 113 | 57 | Smooth | W. |
| Do. | ... 26th " | 2 | 1 | 3 | 101 | 60 | ... | ... | ... | 56 | ... | 223 | 56 | Do. | W.N.W. |
| Skate Roads | ... 7th Aug. | 18 | ... | ... | 169 | 39 | 11 | ... | ... | 47 | 6 | 290 | 58 | Moderate | N.E. |
| Cambois Bay | ... 16th " | 7 | 1 | 19 | 126 | 112 | ... | ... | ... | 21 | 1 | 287 | 57 | Smooth | N.W. |
| Druridge Bay | ... 23rd " | 10 | 1 | 20 | 176 | 157 | 3 | ... | ... | 39 | ... | 406 | 58 | Do. | Calm. |
| Cambois Bay ⁴ | ... 30th " | 3 | ... | 10 | 81 | 44 | 1 | ... | ... | 20 | ... | 159 | 57.5 | Moderate | W., strong. |
| Blyth Bay ⁵ ... | ... 30th " | ... | ... | ... | 20 | 19 | ... | ... | ... | 2 | ... | 41 | 57.5 | Do. | Do. |
| Aldmouth Bay | ... 6th Sept. | 7 | ... | 8 | 241 | 139 | 9 | ... | 5a | 61 | ... | 470 | 58 | Smooth | E. |

¹ 3 hours. ² 3 hours. ³ 4½ hours. ⁴ 5 hours. ⁵ 1 hour.

a. All caught by the line. b. Many of these also caught by the line.

On the same day, the bay which towards the end of last season was visited for the first time with such extraordinary results—Goswick Bay—was trawled over from 7 to 10 a.m. One haul was obtained in this time, a complete record of which is given on page 16, and the fish retained are detailed in Table I. The contrast between these figures and those of last season is only too evident. If we were to use the figures as indicating the rate at which diminution in the numbers of fishes is proceeding on this coast, we should have to point to a very wretched state of affairs indeed.

The subject will come up again in the report on the results of the experiments made with the surface net. But in the meantime, it may be as well to point out that though it may be natural to say that the trawling at Skate Roads on the 21st, was the reason we did not get a good catch on the 23rd, such a course of reasoning would not explain the similarly poor catch at Goswick on the 23rd. It is more likely that the cause of the apparent decrease was the same in each case. A considerable mass of weed got into the net at Goswick, due to the prevailing N.E. wind, and though Skate Roads, from its sheltered position offered cleaner fishing, yet the result as regards numbers of fish was even worse than at Goswick. The weed had therefore nothing to do with it. It might be pointed out that there was a rise in the temperature, the wind was in the north-east, and had been so for two days before, and one or other, or both conditions may have contributed to making the fish draw further out just about the time we were in the district of these bays. The results illustrate how little we yet know as to the causes of such migrations, and also that our records are liable to a great deal of variation.

Five hauls were made at Alnmouth Bay on 5th July, from 10 until 7, all but the first being double hauls. The fishing was very clean despite the fact that a N.E. wind had prevailed for two or three days before. The sea was calm, but there was a fairly heavy ground swell. As at Skate Roads and at Goswick, the fish on the whole were small—a large proportion of quite immature forms being obtained each time. There were no very large fish and the record is below the average in quantity as well for Alnmouth Bay.

Drnridge Bay got the usual length of time on 19th July, but the fish as compared with the records of past years were much below the average for Drnridge, both as regards quantity and quality, the

dabs alone, as in general elsewhere, showing the most steady figures. A large number of jelly fish was got at every haul. During July, August and September, they were more than usually numerous on the coast as net fishermen in general knew to their discomfort.

Druridge Bay was visited again on the 26th July, with a view to determining what contrast would be obtained with a week's interval. It will be seen that almost exactly double the number recorded on the first visit was got on this occasion. It is at least worthy of remark that the temperature of the water had fallen, and that the wind had changed to the west; conditions which are opposite to those referred to in the case of Skate Roads. Even with the improvement in the numbers at this second visit to Druridge Bay, as compared with past seasons, the results are still disappointing.

Skate Roads was again visited on August 7th, and though the wind had just changed to the N.E., and the temperature had risen, the catch showed a considerable return of plaice as well as of dabs to that bay, to say nothing of turbot. Thus our experiments at Skate Roads alone appear to show that in the early part of the season, the fish had gone out into deeper waters, and were gradually returning—such of them as could return. This migration which our other records this year bear out, appears to be a peculiarity of the season, for I do not think that our statistics lend the least support to the inference that it is general. At this last visit to Skate Roads, a large quantity of the “shore” or “dog” crab was obtained at every haul—soft and hard of both sexes. Towards the end of the day, jelly fish were beginning to get into the net. A small quantity of weed from Budle Bay, and several empty Solen shells were also got.

Cambois Bay on the 16th August, got a full day of about 10 hours, 8 hauls being made in the time, and the result expressed the general improvement in the season's fishing, the record showing an increase for this bay in practically all the species. At the third haul, small dabs were present in extremely large numbers, but otherwise the small fish were much as recorded in the detailed table for the first haul. One or two dead *Spatangus*, and one *Asterias* occurred at the third haul likewise. Jelly fish were also fairly common.

Druridge Bay was again visited on the 23rd August, five hauls being made in the $9\frac{1}{4}$ hours given to the experiment. The results of the two previous visits at the interval of a week were shortly considered above. And it must now be added that if the second visit gave a catch double that of the first, the record for the third visit

was almost double that of the second. It bears out what has been remarked upon before that the season's catch in all the bays was showing a gradual improvement. In prime fish as well as plaice there was a large increase during the season, but the improvement was particularly striking in the case of the dabs. The fishing was very clean, as only once did a large quantity of weed get into the trawl. The weed as is often the case was swarming with amphipods, mainly *Paratylus swammerdami* (M. Edwd). It is this form also which is found in large numbers on the nets, and in the boats during the salmon season. A five-bearded rockling was also brought in by the trawl.

On the 30th, both Cambois and Blyth Bays were tried, the former for five hours (four hauls), and the latter for one hour (one haul). The weather was rather disagreeable. For the greater part of the day there was a strong westerly wind, heavy showers were frequent, and a swell was rolling in from the east. It is plain that here the general improvement referred to continued. This improvement culminated in an excellent return for Ahmouth Bay on September 6th, when the highest figure for that bay was recorded. Five hauls were made in splendid weather, the sea being perfectly calm. The improved numbers for plaice and dab are very marked, as may be seen on comparing the returns for the first visit.

The results so far as the keepable fishes are concerned, and the same remarks apply to the small fish as well, may be summed up by saying that a gradual improvement in the catch took place from the beginning to the end of the season. There were relatively fewer fishes along the coast at the beginning of the summer than at the end.

What the reason of this may be it is very difficult, with our present means of investigation to say. It seemed in the early part of the season to be correlated in some way with the temperature and the direction of the wind. But such a gradual change extending over the whole season cannot satisfactorily be referred to such influences. If we had some reliable information as to the relative numbers of fishes at other seasons than the summer, and comparative trials at one or two off-shore stations, the local factors of migration could be better stated. We ought, moreover, to be provided with apparatus for making accurate determinations of density and temperature at different depths.

The experiences of the line fishermen seem to show that during the winter "a few" haddocks and codlings, are added to these

fishes, while further out, but still in the neighbourhood, on grounds which used to yield a considerable number of haddocks, cod, ling and halibut, the take is a very small one indeed, and the three latter forms are almost as conspicuous by their absence to-day as they used to be by their abundance.

A few years ago we used to get at any rate a number of haddocks, principally in 1894-5. There were two obtained in 1896; since which year we have not got one in the trawl on these grounds. Were we to go further out to the spawning grounds of the herring, we should naturally get them and cod, and other forms as well. A large number of trawlers fish on these spawning grounds at the same time as the herring fishermen are fishing with their nets. As the haddock, cod, &c, are concentrated there, attracted by the food supply, there is bound to be a considerable tax on the recuperative forces of such fishes, and a further tax is imposed at the spawning season of these fishes themselves. I believe the effects are becoming very marked. The line fisherman complains that his returns are wretched compared with a period of 20 years ago or more. Indeed, he is year by year being forced to give up the winter white fishing, and if he is still trying to earn his livelihood by fishing, it is by joining the already too large number who are prosecuting the very destructive early winter crab and lobster fishing. This fishing in turn, consequently, is beginning to suffer both in quantity and quality. With regard to the white fishing, even the trawlers admit that the nearer grounds do not supply them with the catches they used to get.

Our experiments, as far as haddocks are concerned, for we now get none, are parallel with the experience of fishermen. The few codling and whiting we obtain show, moreover, that at any rate neither are they common during the summer season in our in-shore waters. But this subject will be further considered in the report on the Fishery Conferences.

To complete the summing up in regard to the round fishes, a table (Table II.) is subjoined which gives the numbers of gurnards obtained at each excursion, and the average for the different years. This fish presents a remarkable variability in the manner in which it may be caught. We may be catching them fairly well in the trawl, and at the same time getting very few with the line. At other times we may be getting a fair number with both methods of fishing. On still other occasions they are caught well by the hook and not by the trawl. Our statistics for this fish are not very satisfac-

tory, because we catch them by line as well as by trawl, and the line fishing is not prosecuted with the same fervour on each occasion. It is a form which spawns to some extent within the limits, and we should expect it to benefit thereby, but so far as our figures go, the gurnard does not appear to be keeping up in numbers.

TABLE II.—GURNARD.

| Year. | Blyth Bay. | Cambois Bay. | Druridge Bay. | Alnmouth Bay. | Skate Roads. | Total. | Average. |
|-------|------------|-----------------|------------------|---------------|--------------|--------|----------|
| 1894 | 41 | 17, 6 | 120 | 49, 17, 85 | 81 | 416 | 52 |
| 1895 | 25, 40 | 7, 85 | 13, 35, 120 | 24, 65 | 30, 70 | 514 | 47 |
| 1896 | 46, 20 | 100 | 83, 143, 124 | 29, 46 | 46, 29 | 666 | 67 |
| 1897 | 23 | 35, 23 | 75, 196 <i>e</i> | 27, 34 | 6, 17 | 436 | 48 |
| 1898 | 7 <i>a</i> | 13 <i>c</i> | 16, 43, 12 | 19, 11 | 6, 0 | 107 | 15 |
| 1899 | 2 <i>b</i> | 21, 20 <i>d</i> | 20, 56, 39 | 12, 61 | 1, 47 | 257 | 32 |

a. 4 hours }
b. 1 " } Left out in making up totals and averages.
c. 7 " }
d. 5 " }
e. All taken by the line.

The flat fish, which, as has been all along quite evident, form the bulk of our take with the trawl, occur in our territorial waters to a limited extent. Plaice and dabs are most numerous, the latter presenting a large number of both mature and immature forms: the former being very variable in regard to the occurrence of mature, but usually presenting a large number of immature sizes. It seems, in fact, that the plaice qualitatively are not so good as they were in the past; and this again agrees with the experiences of the line fishermen who remark the small size of the plaice, as well as of other forms they obtain now compared with former years. We cannot expect to get what have been called deep-sea plaice, in our relatively shallow territorial waters, but two years ago we did get a large number of mature plaice whereas last year and this year the sizes seldom reached those of maturity. Last year I presented the average totals for the flat fish. I venture to repeat the tables in the form I have just given for gurnards.

The figures for plaice are brought together in Table III.: the total number obtained at each excursion is given, and the average for each year is presented in the last column. The other forms are tabulated in similar manner in the succeeding tables. A slight increase in the number of plaice has taken place during the last two years, and it may be said that this fish has improved in numbers

TABLE III.—PLAICE.

| Year. | Blyth Bay. | Cambois Bay. | Druridge Bay. | Alnmouth Bay. | Skate Roads. | Total. | Average. |
|-------|--------------|------------------|---------------|---------------|-------------------|--------|----------|
| 1892 | 88, 20, 60 | 80, 120, 81 | 140 | ... | ... | 589 | 84 |
| 1893 | 59, 37 | 50, 60 | 87, 73 | 116, 75 | ... | 557 | 70 |
| 1894 | 67 | 18, 30 | 140, 50 | 131, 60, 65 | 371, 90 | 1,028 | 103 |
| 1895 | 64, 58 | 37, 71 | 120, 116, 132 | 118, 101 | 120, 75 | 1,012 | 92 |
| 1896 | 85, 63 | 76 | 100, 157, 104 | 202, 154 | 85, 155 | 1,241 | 124 |
| 1897 | 55 | 104, 62 | 129, 102 | 58, 253 | 111, 138 | 1,012 | 112 |
| 1898 | 103 <i>a</i> | 56 <i>c</i> | 105, 70, 83 | 117, 195 | 95, 154 | 819 | 117 |
| 1899 | 20 <i>b</i> | 126, 81 <i>d</i> | 24, 101, 176 | 76, 241 | 51 <i>e</i> , 169 | 964 | 120 |

a. 4 hours
b. 1 "
c. 7 "
d. 5 "
e. Goswick and Skate Roads together, one day's fishing.

} Left out in making up totals and averages.

along our coast during the period in which the territorial waters have been closed to trawling. It has been seen, however, and will be again referred to in the notes on sizes (page 13), that the quality has not kept up. We shall, in future, from the method we have now adopted for recording the first haul, presently to be referred to, be able to present a vigorous and definite contrast in this respect.

TABLE IV.—DAB.

| Year. | Blyth Bay. | Cambois Bay. | Druridge Bay. | Alnmouth Bay. | Skate Roads. | Total. | Average. |
|-------|-------------|------------------|---------------|---------------|-----------------|--------|----------|
| 1892 | 40, 12, 41 | 44, 80, 47 | 70 | ... | ... | 334 | 46 |
| 1893 | 23, 19 | 12, 51 | 67, 39 | 100, 49 | ... | 360 | 45 |
| 1894 | 23 | 11, 18 | 54, 40 | 63, 51, 35 | 22, 30 | 347 | 35 |
| 1895 | 32, 95 | 13, 33 | 15, 60, 70 | 82, 46 | 42, 13 | 501 | 46 |
| 1896 | 44, 78 | 81 | 68, 68, 123 | 117, 44 | 44, 10 | 677 | 68 |
| 1897 | 35 | 73, 113 | 34, 104 | 62, 43 | 20, 30 | 514 | 56 |
| 1898 | 67 <i>a</i> | 82 <i>c</i> | 91, 150, 72 | 59, 113 | 39, 16 | 540 | 77 |
| 1899 | 19 <i>b</i> | 112, 44 <i>d</i> | 65, 60, 157 | 76, 139 | 2 <i>e</i> , 39 | 650 | 81 |

a. 4 hours
b. 1 "
c. 7 "
d. 5 "
e. Goswick; none got at Skate Roads same day, *see* Table I and note to Table III.

} Left out in making up totals and averages.

Table IV. gives a similar summary of our returns for dabs. It shows that a steady increase in numbers of this species is taking place. This is, I believe, the experience of some of the fishermen along the coast, and it is interestingly correlated with the fact that

it is the only flat fish which spawns to some extent within the limits. The closure of the 3-mile limit to trawling is benefitting the dab. The table shows, moreover, that dabs are not very common in Skate Roads, while Druridge Bay, Alnmouth Bay, and now Cambois Bay are comparatively rich in this form.

The succeeding Tables give a similar representation of the returns for turbot, brill and soles. The figures for turbot are very variable, they are seldom large. If the fishermen at Craster are to be believed, they used to catch a fairly large number with their "brat" nets, but now-a-days their results are very poor: see also report for 1896, page 8. Our figures do not show very much, but they certainly illustrate the fact that it is a comparatively rare fish. It seems from such collateral evidence as that just given that it has become so.

TABLE V.—TURBOT.

| Year. | Blyth Bay. | Cambois Bay. | Druridge Bay. | Alnmouth Bay. | Skate Roads. | Total. | Average. |
|-------|------------|--------------|---------------|---------------|--------------|--------|----------|
| 1892 | 0, 0, 2 | 0, 3, 2 | 0 | ... | ... | 7 | 1 |
| 1893 | 3, 6 | 2, 4 | 9, 7 | 9, 3 | ... | 43 | 5 |
| 1894 | 2 | 1, 1 | 27, 7 | 17, 8, 14 | 28, 18 | 123 | 12 |
| 1895 | 1, 4 | 3, 3 | 5, 5, 2 | 7, 3 | 4, 1 | 38 | 3 |
| 1896 | 7, 2 | 8 | 9, 8, 13 | 13, 9 | 7, 50 | 126 | 13 |
| 1897 | 2 | 5, 0 | 22, 19 | 6, 8 | 44, 33 | 139 | 15 |
| 1898 | 1a | 2c | 7, 11, 8 | 11, 9 | 23, 7 | 76 | 11 |
| 1899 | 0b | 7, 3d | 1, 2, 10 | 0, 7 | 1, 18 | 46 | 6 |

a. 4 hours

b. 1 ..

c. 7 ..

d. 5 ..

} Lett out in making up totals and averages.

TABLE VI.—BRILL.

| Year. | Blyth Bay. | Cambois Bay. | Druridge Bay. | Alnmouth Bay. | Skate Roads. |
|-------|------------|--------------|---------------|---------------|--------------|
| 1892 | 0, 0, 0 | 0, 0, 0 | 1 | ... | ... |
| 1893 | 0, 0 | 0, 0 | 0, 0 | 0, 0 | ... |
| 1894 | 0 | 0, 0 | 0, 0 | 0, 0, 0 | 0, 0 |
| 1895 | 0, 0 | 0, 0 | 0, 0, 0 | 0, 0 | 0, 0 |
| 1896 | 0, 0 | 0 | 0, 0, 0 | 0, 1 | 0, 1 |
| 1896 | 0 | 0, 0 | 1, 0 | 0, 0 | 7, 2 |
| 1898 | 0 | 0 | 1, 2, 0 | 0, 2 | 5, 1 |
| 1899 | 0 | 1, 0 | 0, 1, 1 | 1, 0 | 2a, 0 |

a. Goswick: no brill got this year at Skate Roads.

Brill are very rare as is well shown in Table VI., which graphically indicates the few we have obtained, and their distribution.

TABLE VII.—SOLE.

| Year. | Blyth Bay. | Cambois Bay. | Druridge Bay. | Alnmouth Bay. | Skate Roads. | Total. | Average. |
|-------|-------------|-----------------|---------------|---------------|--------------|--------|----------|
| 1892 | 1, 0, 3 | 0, 7, 8 | 13 | ... | ... | 32 | 5 |
| 1893 | 56, 17 | 3, 16 | 24, 28 | 8, 11 | ... | 163 | 20 |
| 1894 | 43 | 20, 59 | 5, 36 | 5, 18, 8 | 1, 1 | 196 | 20 |
| 1895 | 12, 20 | 4, 4 | 6, 12, 11 | 4, 7 | 0, 3 | 83 | 8 |
| 1896 | 5, 36 | 24 | 35, 8, 26 | 30, 9 | 5, 2 | 180 | 18 |
| 1897 | 3 | 32, 15 | 37, 15 | 2, 10 | 5, 6 | 125 | 14 |
| 1898 | 11 <i>a</i> | 7 <i>c</i> | 3, 6, 3 | 3, 0 | 1, 2 | 15 | 2 |
| 1899 | 0 <i>b</i> | 19, 10 <i>d</i> | 1, 3, 20 | 1, 8 | 0, 0 | 52 | 6 |

a. 4 hours
b. 1 "
c. 7 "
d. 5 "

} Left out in making up totals and averages.

Table VII. seems to show that the true sole is also becoming scarcer in our in-shore waters.

TABLE VIII.—FLOUNDER.

| Year. | Blyth Bay. | Cambois Bay. | Druridge Bay. | Alnmouth Bay. | Skate Roads. | Total. | Average. |
|-------|------------|---------------|---------------|---------------|-----------------|--------|----------|
| 1892 | 0, 0, 0 | 0, 0, 0 | 0 | ... | ... | 0 | 0 |
| 1893 | 0, 0 | 0, 0 | 0, 0 | 0, 0 | ... | 0 | 0 |
| 1894 | 2 | 4, 0 | 3, 2 | 14, 4, 7 | 19, 9 | 64 | 6 |
| 1895 | 0, 0 | 0, 0 | 2, 0, 0 | 0, 0 | 0, 0 | 2 | 0 |
| 1896 | 0, 2 | 0 | 0, 1, 1 | 3, 3 | 0, 32 | 42 | 4 |
| 1897 | 5 | 0, 0 | 3, 3 | 1, 5 | 21, 10 | 48 | 5 |
| 1898 | 1 <i>a</i> | 1 <i>c</i> | 1, 3, 2 | 18, 5 | 6, 7 | 42 | 6 |
| 1899 | 0 <i>b</i> | 0, 1 <i>d</i> | 1, 0, 3 | 12, 9 | 6 <i>e</i> , 11 | 42 | 6 |

a. 4 hours
b. 1 "
c. 7 "
d. 5 "
e. Goswick and Skate Roads together, one day's fishing.

} Left out in making up totals and averages.

The flounder is not a favourite flat fish as an article of food. Table VIII. shows that it is not very common, and illustrates its relative predominance in Alnmouth Bay and Skate Roads, where the fresh water which determines its distribution is contributed by the well-known streams and rivers which pour into these bays.

Table IX. shows in an important manner the total number of flat fishes obtained at each excursion, and the average for each year. So far as the flat fishes in our territorial waters are concerned, we can thus show the gratifying state of affairs that an

TABLE IX.—TOTAL FLAT FISHES.

| Year. | Blyth Bay. | Cambois Bay. | Druridge Bay. | Alnmouth Bay. | Skate Roads. | Total. | Average. |
|-------|-------------------|-----------------------|---------------|---------------|-----------------------|--------|----------|
| 1892 | 129,32,106 | 124, 210, 138 | 221 | ... | ... | 963 | 138 |
| 1893 | 141, 79 | 67, 131 | 187, 147 | 233, 138 | ... | 1,123 | 140 |
| 1894 | 137 | 51, 108 | 235, 135 | 235, 135 | 411, 118 | 1,628 | 181 |
| 1895 | 109, 177 | 57, 111 | 118, 193, 215 | 118, 193, 215 | 166, 92 | 1,824 | 152 |
| 1896 | 111, 181 | 189 | 272, 212, 267 | 272, 212, 267 | 141, 250 | 2,464 | 224 |
| 1897 | 100 ^{aa} | 214, 190 | 226, 243 | 226, 243 | 208, 219 | 1,769 | 221 |
| 1898 | 183 ^a | 118 ^c | 208, 242, 168 | 208, 321 | 169, 187 | 1,506 | 215 |
| 1899 | 39 ^b | 265, 139 ^d | 92, 167, 367 | 166, 401 | 62 ^e , 237 | 1,760 | 220 |

aa. 3½ hours

a. 1 ..

b. 1 ..

c. 7 ..

d. 5 ..

} Left out in making up totals and averages.

e. Goswick and Skate Roads together, which gives one day's fishing.

increase occurred during the first five years of these excursions, and the numbers have remained fairly steady since. As has been before remarked there is not the increase which might have been expected. What we have learned about the spawning migrations of these fishes gives us the necessary explanation. But there is no doubt at all that the protection afforded to the large numbers of immature, and also to the mature fish which spend a part of their lives in-shore, more than warrants the Northumberland Sea Fisheries Committee in keeping the territorial waters closed to trawling. The destruction of immature fish which takes place even as it is in off-shore waters, would be greatly intensified, and the fish of the territorial waters practically exterminated if continuous trawling were again allowed within the limits.

THE SIZE, FOOD, SEX AND DEGREE OF MATURITY OF THE FISHES.

While considering the results so far as they relate to the larger fishes we obtained, it will be convenient to present in a summarized form the observations made on the fish dissected on board the "Livingstone."

PLAICE.—Thirty-three examples were measured; a fair proportion measured 18 to 20 inches at Druridge Bay on the 23rd August, but a great majority were less than mature size. The mature size for females appears to be not less than 16 inches, but males appear to become ripe at from 14 to 15 inches. Among twenty-

three, eleven were feeding upon *Tellina tenuis*, two on *Donax trunculus*, three on sand-eels, two on sand-eels and *Tellina tenuis*, one on sand-eels, annelids, and *Tellina tenuis*, one on annelids and *Tellina tenuis*, one on Echiurus, and two were empty. There were seventeen females and six males.

DABS.—Twenty were measured, the majority being 10 to $12\frac{1}{2}$ inches in length. Maturity is reached in the dab at about 11 or 12 inches, and an increasing number of both young and adult seem to be met with in our district waters. Among seventeen, six were feeding upon *Portunus holsatus*, five upon amphipods, one on sand-eels, one on sand-eels and mollusc (unrecognizable), one on *Donax trunculus* and *Tellina tenuis*, one on *Portunus holsatus* and small lamellibranchs with shingle, one on unrecognizable animal tissue, and one was empty. All were females.

FLOUNDERS.—Five were measured—9, $9\frac{3}{4}$, 11, $11\frac{1}{2}$, $16\frac{1}{2}$ inches in length. One was feeding on sand-eels, one on *Tellina tenuis*, and three were empty. There was one male, the rest being females.

TURBOT.—Twelve were measured, giving sizes from 12 to 19 inches. The females above 17, and the males above $15\frac{3}{4}$ inches were mature. Three were feeding upon weevs, three on sand-eels, two on small herrings, one on sand-eels and small herring, and three were empty.

BRILL.—Among three measuring $9\frac{1}{2}$, $10\frac{1}{2}$ and 17 inches, two were males, and one was a female. They were feeding upon sand-eels.

SOLE.—The sole was obtained from $10\frac{1}{2}$ up to 19 inches in length; 17 were measured, maturity being noted from 15 inches. Among fourteen, three were feeding upon sand-eels, two upon annelids, one upon annelids and sand-eels, and eight were empty. There were twelve females and two males.

GURNARD.—Among thirteen gurnards measuring $9\frac{1}{2}$ to $17\frac{3}{4}$ inches (maturity being observed from 11 inches), two were feeding upon *Portunus holsatus*, two upon sand-eels, two upon shrimps, one upon sand-eels and shrimps, and one upon very small flat fish and shrimp. (The flat fish measure from 17 to 22 mm. less the tail fin, eyes dextral. They seem to be young dabs, but might be young plaice or flounders). There were twelve females and one male.

MACKEREL.—Two of the mackerel caught by the line measured $15\frac{1}{2}$ and 16 inches. They were both females, and both mature. Their stomachs contained herrings measuring about five inches.

CODLING.—A 17 inch codling, an immature female had fed upon *Portunus holsatus*.

ANGLERS.—Seven specimens measuring 15 to 21½ inches, one giving 30 inches, were feeding upon weevils (in three instances), dabs (in one case), and the rest were empty. The majority of them were immature females.

As on previous occasions, notes were made and in some cases specimens preserved of the abnormal or diseased fishes we obtained. Many of the flat fishes, particularly turbot, plaice, and flounders were procured more or less pigmented on the "white" or "blind" side. One dab was observed, likewise, thus pigmented in the region of the caudal fin, on and between the pectoral and pelvic fins, with an isolated small area on the lateral line, but there were no spots corresponding to those on the upper side.

A 15 inch *Lophius piscatorius*, caught on 5th July, had a conspicuous cystic tumour on the caudal fin, the cause of which was not apparent. Similar tumours were also observed on the tail of a flounder. The Angler is often seen to present, in the walls of the stomach, tumours containing Nematode worms.

THE MATURE v. THE IMMATURE FISH.

The following records give a complete account of all the fishes obtained at the first haul. Although in previous years a contrast was made, in so far as the fish obtained could be compared with those returned to the sea, it did not clearly indicate the sizes in the two classes. Nevertheless, so long as the fishing was fairly level in quality, the figures presented in previous reports give a pretty reliable proportion which will be interesting in relation to those which are now given. A comparison of the numbers given here with countings which were made to bring the results into line with those of previous seasons shows that the plaice retained were above 11 to 12 inches long, the dabs above 8-9 inches long, flounders above 10-11 inches, gurnards above 9-10 inches, the soles and turbot were seldom small, and might be assumed on the whole to be mature or nearly so. Holt in his researches on maturity at Grimsby, gives 7 inches for the dab. I have not been able to confirm this yet, but if it be correct, then all dabs retained are certainly mature. My figures for the other forms come pretty close to those which Holt has given, and may be used, for the present at least, in briefly discussing the tables.

U. - ALNMOUTH BAY, 5th July (1; hours).

SHIH CHU

| | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | Total. |
|-------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--------|
| Plaice .. | ... | ... | 2 | 1 | 7 | 3 | 1 | 6 | 6 | ... | 2 | ... | ... | 1 | ... | ... | ... | 29 |
| Dab .. | ... | ... | ... | 11 | 24 | 20 | 10 | 3 | ... | 1 | ... | ... | ... | ... | ... | ... | ... | 69 |
| Flounder... | ... | ... | 1 | 4 | 4 | 4 | 3 | 2 | ... | ... | ... | ... | ... | ... | ... | ... | ... | 18 |
| Gurnard .. | ... | ... | ... | ... | 1 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 1 |
| Colling .. | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 1 | ... | ... | ... | 1 |
| Angler .. | ... | ... | ... | ... | ... | ... | ... | ... | ... | 1 | ... | 1 | ... | 1 | ... | ... | ... | 3 |

D. DRURIDGE BAY, 19th July (1½ hours).

SHONZHI

[illegible]

H.—DRURIDGE BAY, 23rd August (1½ hours).

I.—CAMBOIS BAY, 30th August (1½ hours).

| INCHES. | | | | | | | | | | | | | | | | | Total. |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--------|
| 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | |
| Plaice . | ... | 8 | 20 | 5 | 5 | 7 | 6 | 9 | 7 | 6 | 7 | 3 | ... | ... | 1 | ... | 84 |
| Dab | ... | 2 | 2 | 18 | 20 | 2 | ... | 2 | ... | 1 | ... | ... | ... | ... | ... | ... | 47 |
| Turbot .. | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 1 | ... | ... | ... | ... | 1 |
| Sole | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 1 | ... | 1 | ... | ... | 2 |
| Flounder . | ... | ... | 2 | ... | ... | 1 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 3 |
| Gurnard | ... | ... | 9 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | ... | ... | ... | ... | ... | 20 |

J.—ALNMOUTH BAY, 6th September (1¹ hours).

PLAICE.—The only really mature plaice obtained at the first haul was one each at Alnmouth Bay and Cambois Bay. If the limit were fixed at 12 inches, that is to say, if we assume that all fish might be retained which are 12 inches and over, though those from 12 to 16 inches must be held to be immature, a glance over the tables will serve to illustrate two facts which have been pointed out before. (1) The increase in those above 12 inches was accompanied by an increase in those below 12 inches; (2) this increase was a gradual one from the beginning of the season's fishing to the end, but was most marked as regards those over 12 inches at the last three excursions. A large proportion of mature forms was got at Druridge Bay on 23rd August, in the succeeding hauls to that recorded in the above table, but the season as a whole has been remarkable in the paucity of plaice of the mature size (in this connection see last two reports).

DAB.—In the case of the dab on the other hand, assuming that Holt's size is the correct one for the mature condition in the North Sea, the large majority of those caught are mature. Even if we increase the size by an inch or so, the proportion of mature is still very large. This shows that in the in-shore waters, the dab occurs to a marked extent in the mature condition. We have seen that it spawns there, and we not only get the ova and the mature fish, but a large number of the smaller sizes as well.

The other forms I do not propose to discuss on this occasion, but the value of these records will be more apparent when we can compare them with similar figures for successive years.

PELAGIC OVA.

As in former years, the floating life including the eggs of such fishes as spawn in or near the district was investigated by means of a surface, and a mid-water net. The former was towed near to the surface, and the latter was attached to the beam of the trawl. The main results are tabulated below. It will be seen that the weever was breeding freely in the district during June and the early part of July. On July 26th, one egg each of the weever, dab and gurnard was obtained, after which date no more pelagic eggs were found. This is in entire agreement with our previous reports. Very few eggs of the dab were procured, but a fair number of the eggs of the gurnard and five-bearded rockling.

WEEVER, *Trachinus vipera*.

| | | SURFACE. | | MID-WATER. |
|----------------------|-----|----------|-----|------------|
| Skate Roads, 21 June | ... | 70 | ... | — |
| Goswick Bay, 23 June | ... | 54 | ... | — |
| Skate Roads, ,, | ... | 12 | ... | 4 |
| Alnmouth Bay, 5 July | ... | 30 | ... | 0 |
| Druridge Bay, 19 ,, | ... | 4 | ... | — |
| ,, 26 ,, | ... | 1 | ... | 0 |

A ripe weever from which the ova was issuing was obtained in the trawl at Goswick Bay. And on this occasion it was noted that the top layer of the water in the bottle contained only the eggs of the weever, the other forms were got when the bottom layers of the bottle were examined.

DAB, *Pleuronectes limanda*.

| | | SURFACE. | | MID-WATER. |
|----------------------|-----|----------|-----|------------|
| Goswick Bay, 23 June | ... | 2 | ... | — |
| Alnmouth Bay, 5 July | ... | 4 | ... | 0 |
| Druridge Bay, 26 ,, | ... | 1 | ... | 0 |

FIVE-BEARDED ROCKLING. *Onos mustela*.

| | | SURFACE. | | MID-WATER. |
|----------------------|-----|----------|-----|------------|
| Skate Roads, 21 June | ... | 30 | ... | — |
| Goswick Bay, 23 June | ... | 12 | ... | — |
| Skate Roads, ,, | ... | 6 | ... | — |
| Alnmouth Bay, 5 July | ... | 20 | ... | 0 |

GURNARD, *Trigla gurnardus*.

| | | SURFACE. | | MID-WATER. |
|--|-----|----------|-----|------------|
| Skate Roads, 21 June | ... | 10 | ... | — |
| Near Inner Farne in the "Kettle," 22 June | ... | 3 | ... | 0 |
| Skate Roads, 23 June | ... | 2 | ... | — |
| Alnmouth Bay, 5 July | ... | 25 | ... | 0 |
| Druridge Bay, 26 ,, | ... | 1 | ... | — |

One egg got at Alnmouth Bay on 5th July was clearly that of the Dragonet, *Callionymus lyra*. There was no oil globule, and the egg measured .7692 mm. Its appearance on the day after its capture is shown in fig. 1, as well as a small portion of the characteristic honeycomb like marking of the vitelline membrane due to hexagonal ridges on the outside of that membrane as was pointed out first by McIntosh. Next day or some $21\frac{1}{2}$ hours later, the progress in development is seen in fig. 2, but the ridges of the vitelline membrane are omitted. Black branched pigment spots have now

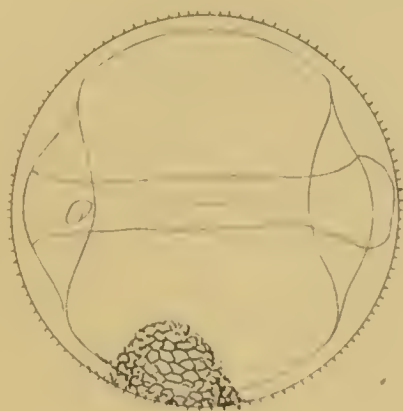


Fig. 1.



Fig. 2.



Fig. 3.

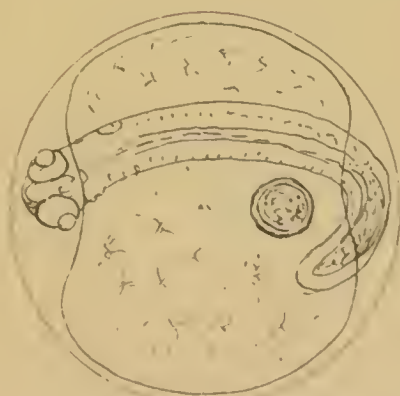


Fig. 4.



Fig. 5



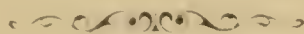
appeared upon both embryo and yolk sac, those on the latter being the more dendritic, as well as unbranched spots, especially on the tail. After a further period of $27\frac{1}{2}$ hours, the larva was found to have emerged, and it was then sketched in the living condition (fig. 3), in the position which it commonly assumed with the yolk sac upwards, but when it turned on its side, the broadly compressed form of the larva was observed. It was found dead next day.

Very few eggs were got in the frequent trials which were made during the summer at Cullercoats, but these were mostly made late in the season. One egg of the gurnard was obtained $\frac{1}{4}$ to 1 mile off Cullercoats, on 19th June. One egg of the brill was observed in the surface material got at the first excursion of the Northumberland Coast Club. This was on 24th July, over a depth of 23-26 fathoms, N.E. of Cullercoats, *i.e.* some 5-6 miles off. It was noted first the same evening, as well as the following characters: diameter 1.38×1.35 mm., oil globule .25 mm., the pigment according to my notes was black on oil globule, yolk sac and embryo; the tail of the latter was not yet bent over to the ventral side of the yolk sac.

Next day some 16 hours later, the egg was sketched (fig. 4). The embryo during this time had made some progress, the tail now curving round as seen. The pigment on the oil globule was then noted to be black and yellow, that on the yolk sac, yellow and brown with one or two black spots, that on the embryo was brown with occasional black spots.

About 24 hours later, the tail was found to have reached round to near the head (fig. 5), and the black pigment was now seemingly confined to the portion of the tail next the yolk sac (proximal end), and to the oil globule. The brown and yellow pigment was much as before, but the dendrites were much elongated on yolk sac. Next day it was found to be dead.

I think there can be little doubt that this egg was that of the brill (*Rhombus laris*).



REPORT ON THE CONFERENCES HELD
AT
CERTAIN OF THE FISHING CENTRES OF
NORTHUMBERLAND.

We have been content in the past to rely almost entirely upon the results of our trawling experiments for information in regard to the condition of our in-shore waters. These are made at the only time available, viz., during the summer, and consequently do not afford a comparative statement as to the winter, when line fishing is prosecuted to some extent along the coast. The experiments do not afford any information either as to the nearer grounds, which are not inside the territorial waters, and such forms therefore as only come in occasionally, e.g., the haddock, can only be inadequately reported upon or not at all. Nevertheless, we are convinced that the statistical information we already possess, even though it only apply to a small portion of the year and to the purely in-shore fish, offers the only final and reliable figures available. If we turn to the Board of Trade's reports for information, we have to remember the serious and seemingly well-founded accusation that, except for one or two places as far as our district is concerned, the statistics are worthless. One does not come into contact with fishermen, however, without hearing over and over again very serious complaints in regard to the state of their calling. The figures, they say, which the Board of Trade get for the villages at least, are made up by men who know nothing about fish and fishing and are quite erroneous, and therefore are not the standard they are meant to be by which the condition of the fisheries can be judged. They will point out glaring examples of errors and appeal to their comrades to bear them out. The charge becomes serious when merchants of standing in the district say that it is quite true and would be seen to be true by anyone who would care to analyse the figures.

It thus became desirable to get from the fishermen a statement as to the condition of the fisheries, and the meetings which the Technical Education Committee desired to be held in the district

were therefore arranged in the form of conferences. The bill calling the meeting in each case contained the following announcement :—

It is proposed to consider such of the following questions as may be interesting to the fishermen :—

1. The number of men and boats regularly or occasionally employed ; the kinds of fishing and the periods devoted to each at the present time, compared with past years.
2. Whether the take of different kinds of fish has increased or decreased, viz : crabs, lobsters, turbot, brill, sole, plaice, dab, haddock, whiting, cod, ling, herring, salmon.
3. Whether the fishing grounds have changed, and if so for what reason.
4. Where the bait commonly used is procured, and whether local beds could be established and preserved.
5. Marketing facilities.
6. The gear in common use and methods of preserving it.

The first meeting was arranged to be held in North Sunderland on 8th September, but unfortunately for me, though very fortunately for the fishermen, that date saw one of the best catches of herrings of the season. Only two fishermen, the chairman (Col. Marshall), Mr. Ewing, and Mr. King attended, and it was agreed to postpone the meeting. I took the opportunity, however, to interview the fishermen I met, and the information I obtained will be embodied in the report of the subsequent meeting.

HOLY ISLAND.

On the 9th of September the first of two meetings was held in Holy Island—the Vicar in the chair. Here the success of the meeting was somewhat interfered with by the herring fishing, but there was an attendance of 18 at this meeting and of 30 on the 11th at the second meeting, when the schoolmaster was in the chair.

The men complained principally that the line fishing has been so seriously reduced by the trawlers that it is now not worth prosecuting, that the fishermen in consequence are being compelled to go more and more in for crab and lobster fishing, with the result that this latter fishing is suffering in turn. Before the days of trawling there was a natural rest given to all kinds of fishing. The herring fishing was prosecuted from July until the beginning of October. The line fishing naturally followed from October to February and pot fishing filled in the time from February until the beginning again of the herring season. The change which has been taking place is that more and more have given up the line fishing, and the crab fishing, instead of being prosecuted for

a part of the year, is now engaged in practically all the year round by an increasing number of fishermen. The decrease in the fishing was shown moreover by the fact that young men were leaving it more than used to be the case. Some of the fishermen could remember when 32 boats went to the herring fishing from Holy Island. Now-a-days only four boats, representing 24 men, go. This could be explained, of course, from the attractions which better markets gave, but the fact was that the number of men had at anyrate decreased. About 60 men are engaged at the fishing there now; some 20 to 30 years ago there were 74 men.

The following comparative statements were made to show the serious changes which had taken place with regard to the winter white fishing. They could catch on the same ground about 8 or 10 miles off, three times the quantity of fish got at the present period. With four lines of 700 hooks 30 years ago, 80 stones was the average catch; now-a-days 35 stones was the best catch of haddocks with five lines of 1200 hooks each. In this fishing they are in the habit of baiting with mussels in winter and sand-eels in summer. Flat fishes had also seriously decreased according to their opinion.

CRABS.—With 150 creels, 35 score was the best result this season, the average may be set down as 25 score; 50 years ago with 20 creels 60 to 70 score could be got in a night.

LOBSTERS.—The fishermen say that the lobsters are now neither so large nor so numerous, in fact they have decreased both in quality and in quantity. As recently as five years ago 108 stone could be obtained, 20 stone is the best catch now-a-days. There was a local law among the fishermen that no fishing could be undertaken for crabs and lobsters outside of the months December to May inclusive. Now-a-days the fishing, as has been said, is prosecuted practically all the year, and it takes very many more pots to obtain a catch which is certainly less than the catch of some few years ago. While acknowledging that the close time for the berried hen is bound to be beneficial, recognising the fact that they couldn't have the chicken and eat the egg as well, they said that fishermen could evade the Act if they felt so inclined. The impression was that if hatcheries could be established similar to those in Newfoundland and Nova Scotia the man could thus obtain his lobster in exchange for the "berries," and there would be no temptation to stripping. This, however, will be discussed when the information from other centres is presented.

HERRING FISHING.—The decrease in the number of boats has already been pointed out. The Holy Island fishermen say that trawlers are to blame for breaking up schools of herring, disturbing old spawning grounds, besides interfering with the net fishermen by taking possession of the ground. The fishermen are thus obliged often to launch their nets in places they would certainly not put them if they had a choice.

HADDOCK FISHING.—The haddock ground is five to seven miles off Emmanuel Head, in 40 fathoms. Ten to twelve stones a day were got, including, as well as cod and ling, halibut and skate. Now they are so scarce that, at certain seasons at least, the fishermen are obliged to send to Shields and Aberdeen for bait for their creels—line fishing not furnishing a sufficient quantity.

BAIT.—In consideration of one shilling a year paid to the Earl of Tankerville each fisherman can obtain as much bait off the Fenham Slakes as he requires. Lord Tankerville's part of the slakes is that south of the Foulworth Burn, and it is the habit of the fishermen to remove the mussels in the young condition from the ground to the north of that burn belonging to C. J. Leyland, Esq., of Haggerston Castle, to the Tankerville ground where they grow better to bait size. The fishermen on their part aid in protecting the oyster scarp near the Beacon Point. The mussels grow on the slakes so well naturally that I have no hesitation in recommending that the proprietors should be approached with a view to making experiments as to the possibility of increasing the supply. The fishermen at Holy Island would not object to this, nor to a bye-law being passed for regulating and protecting the bait supply, if the privilege that they have so long enjoyed were not interfered with.

MARKETING FACILITIES.—Complaint was made that the North Eastern Railway charged too high for carriage. Large centres enjoy greater privileges, and also consigners who send in large quantities. When the fishermen send for bait to Aberdeen or Shields more is charged for rate than the value of the fish. The charge from Aberdeen is 2/6 to Berwick, and for the same quantity 2/6 is charged from Berwick to Beal (8 stone lots). They were of opinion that bait ought to be charged at a low rate because it was meant to catch crabs and lobsters which would again be sent away by rail. It is only four years ago that this practice of sending away for bait was adopted from the middle of March till the middle of May. During this period the bait cannot be procured locally. As a rule,

5/- must be received per barrel of crabs and lobsters before the fisherman can get anything himself.

GEAR.—The crab pots are usually made with the “eyes” at the the side and alternate. The net is tarred but the wood is not protected. The nets, sails, and lines are preserved with tan.

With reference to trout and salmon fishing, it may be added that the stake nets belonging to Sir William Crossman are used on the north side of the island, and trout fishing is prosecuted in the harbour but not very successfully, and no licence is required.

Berwick, 30th September.

There was a small attendance (12), probably because the weather was very stormy, at Berwick on this Saturday evening, when I was obliged to make my visit a short one. The audience included Mr. Gray (chairman), the Fishery Officer for the Northern District of Northumberland, as well as the Scottish Fishery Officer for the Berwick district, and with their help I was able to get some very useful information bearing on the questions we are now considering.

Trawlers occasionally visit Berwick, but only when weather compels them. The local boats occupied in the herring fishing were 11 at Berwick, 3 at Spittal—14 in all. Strangers would bring the number up to about 50. The cobbles engaged in line and pot fishing are 15 at Berwick, 10 at Spittal; this gives employment to some 100 fishermen altogether. About 20 years ago there were 5 or 6 cobbles more at Berwick and a corresponding number of men. The young men, it is said, are leaving the fishing for other industries. Instead of rather over 20 boats engaged in the line fishing 20 years ago at Berwick, there were only 8 boats last year. More and more of the cobbles are in consequence being used in crab and lobster fishing. The crab and lobster fishing, as in other places, used to be engaged in from February to May, giving a rest to this particular kind of fishing, but those fishing all the year round are increasing in number year after year, because the line fishing is not worth prosecuting. Consequently a larger number of crabs are being caught, as is shown in the following numbers which were handed to me by Mr. Buglass, the Fishery Officer for the Northern District of Northumberland:—

| Year. | | | | No. of Crabs. |
|----------|-----|-----|-----|---------------|
| 1895 ... | ... | ... | ... | 65,960 |
| 1896 ... | ... | ... | ... | 269,085 |
| 1897 ... | ... | ... | ... | 214,215 |
| 1898 ... | ... | ... | ... | 331,149 |

LINE FISHING, which employed 20 years ago 22 boats out of Berwick alone, gave permanent fishing all the year to those who cared to prosecute it. The principal season, however, was from October to May, and during these months each man could get some $\frac{3}{4}$ cwt. at a time. Now-a-days only January and February give a moderate yield to 8 boats from Berwick and 12 from Spittal, 4 men going with each boat.

The following numbers for haddocks I again owe to Mr. Buglass :—

| | | Cwts. | | £. |
|------|-----|-------|-----|-------|
| 1895 | ... | 7,471 | ... | 3,926 |
| 1896 | ... | 9,462 | ... | 3,364 |
| 1897 | ... | 4,050 | ... | 2,347 |
| 1898 | ... | 1,546 | .. | 1,304 |

It may be added that this year for nine months gives a return below the same period for last year. These numbers are among the most reliable which the Board of Trade obtains, but previous to 1895 they are not to be depended upon, and show, as well as numbers can show, the diminution in the catch, and the decrease in the number of fishermen engaged in the haddock fishing; at the same time the corresponding numbers given above show the increased attention devoted to crab and lobster fishing.

HERRING FISHING.—The local herring fishing has also decreased. Some of the boats, however, go to the early herring fishing. Three boats went to Ireland, one to Lowestoft, and two were fishing from Shields this season.

FISHING GROUNDS.—Twenty-five to 30 years ago the best results were obtained in line fishing the further out the boat went. To-day the opposite is the case. The fishermen have to keep pretty close to the shore to obtain a catch. Some of the Spittal boats fish for plaice at Goswick in the month of March, but soon exhaust them and nothing is left. Halibut used to be very common 40 to 50 years ago. They are now seldom seen, one fisherman said there were more destroyed then than one can catch now.

The fishermen are naturally desirous to be allowed to fish for salmon in the sea off the Tweed, but the large mouth of the Tweed, as defined in the Tweed Act, debars them at present. An effort, I believe is being made to bring the Tweed under the Scotch River Act.

BAIT.—The bait is bought from Budle Bay Mussel Farm; 16d. a basket being charged, 22 baskets going to the ton. The bait for

the crab pots is usually fished, but when it cannot be got through stress of weather or scarcity of fish, it is sent for to some one or other of the trawling centres. A local supply of mussels occurs at the mouth of the Tweed and the Spittal fishermen utilize them. Mussels also grow in Tweed Dock, though curiously enough they don't grow just outside. An opinion prevailed that mussels might be cultivated at the mouth of the Tweed, and that a bye-law for regulating and protecting such cultivated beds as well as bait in general would be very useful.

MARKETING FACILITIES.—The rate for crabs is 3/6 per cwt. to the Midlands, 4/6 to London. Carriage and market dues average 6d. per stone; that is to say, the fisherman must obtain 6d. per stone before he gets anything himself.

The produce of the fisheries is usually now-a-days, however, bought by local merchants. The meeting was of opinion that the value of the article carried ought to be considered by the Railway Company, for fish, as things go at present, is charged at a rate not much less than that for flesh.

It was told me afterwards, with reference to the fishing in-shore for haddocks, &c., that the Eyemouth boats compete in the in-shore grounds from December to March with the Berwick fishermen, that is to say, off Berwick for a meagre supply of haddocks. This supply often does not pay expenses and occasionally so few are obtained that the fish are not worth bringing ashore.

CRASTER, October 2nd and 3rd.

Sir Edward Grey was to have taken the chair, but he telegraphed that he was unexpectedly called to London. Mr. W. Archibald took the chair at both meetings, which were attended by a large number of fishermen and others interested. I should say that some 100 attended each night.

NUMBER OF BOATS.—**HERRING BOATS.**—Thirty years ago there were 39; 20 years ago 36; there were only 6 at the herring fishing this year.

COBLES.—Thirty years ago there were 19; there are only 10 this year. There has been a steady decrease in boats as in men, but it has been most rapid in recent years. Ten cobbles give employment to say 30 men, but there are three laid off this winter and the men have gone to work in the quarries. Some of the men that were engaged at the herring fishing are now at work at the quarries—work for which their training as fishermen does not fit them. It

might be said then that during the last 30 years the number of men engaged in fishing at Craster has been reduced.

HERRING FISHING is prosecuted from mid-June to mid-September, line fishing from end of September to end of February. A few boats used to fish with the line all the year round. All are now restricted by the circumstances of the fishing to that period or a part of it.

Crab and lobster fishing used to come in between the line and herring fishing; there was a local manorial law which prevented fishing outside that period, that is to say the months of March, April, and May, but that law becoming inoperative about 30 years ago, crab and lobster fishing is now prosecuted all the year, and to an increasing extent every year. The bait for the pots used to be caught by the lines. Now it has to be bought during the spring crabbing season.

TURBOT FISHING is prosecuted during July, August, and September, seldom in October, with nets known as brat nets—brat being the local name for turbot. The turbot were got on the herring spawning ground, about three to four miles out. The nets are 210 yards long, and are made with very wide meshes, each mesh measuring 7 ins. along the side of the square; they are seven meshes deep. Sinkers (small stones) are tied to the lower edge at intervals of nine meshes, and small corks keep the upper edge up in the water. They are shot at the "slack" of the tide usually, the nets being placed in the water in a straight line and the fish simply entangle themselves in the meshes. This fishing used to yield good results, but like most of the other forms of fishing it is now considerably reduced. Over 30 years ago, with five nets fishing together as one fleet, some 45 turbot could be got. Now, as was remarked, 5 turbot and 45 nets would be more like the result.

HADDOCKS.—That the haddock fishing has decreased is shown from the following statement of one fisherman with the assent of the rest. Last Friday one boat got none with three lines of 1,800 hooks each. Another boat obtained two haddocks on one line of 1,800 hooks. With the same number of hooks 20 years ago, 20 stones and upwards could be obtained. The ground is changed; they used to be fished on the smooth, they are now principally got on the hard ground. The best ground was from five to six miles and further out; now it is from three miles inwards. This agrees with the report from Berwick.

With regard to flat fishes, the same was said—they have all without exception decreased. The flounder is very rare. Plaice were never numerous, but they are less numerous now. The dab is likewise not got in such large numbers.

TRONT FISHING.—No license is required and the season finishes on 31st August. This limit appeared to the fishermen to be a hardship. An extension to the 20th September would give employment to many fishermen, and they say there are more tront on the coast during September than the whole of the previous part of the open season. From Newbiggin to Howick Burn, just to the south of Craster, the season extends to the 14th September. The opinion was expressed, moreover, that the law in regard to fishing with a "fixed engine" was more constantly broken than observed and ought to be withdrawn. Fishing with a drift net is often impossible, and especially on a rocky shore.

HERRING FISHING.—The herring fishing seems to be suffering from the effects of trawling. What fishermen believe is that the trawlers, incessantly dragging their trawls through the herring spawn, break it up, destroy much of it, and at the same time disturb and break up the shoals of herring. One fisherman said he counted as many as 23 trawlers at once on the same herring ground. The herring fishing in consequence, they believe, is suffering. Places where, five to six years back, herring were plentiful afford now scarcely any. The shoals are broken up and the fishing is now very "spotty."

HARBOUR.—The foregoing was what transpired at the first evening's meeting. At the beginning of the second meeting, a statement was made as to the great need of a harbour at Craster, and though it did not occur on the programme I thought it desirable to introduce it in my report. At present the cobbles have to be hauled up or have to be taken to Bonhuier or Newton if the sea is rough. Great anxiety prevails, especially if the large boats are riding at Craster. There is naturally a considerable loss of time and fishing when the boats have to be taken to other harbours. Three schemes have already been prepared, and according to the extent of the harbour designed these would cost (1) £36,000, (2) £5,000 to £6,000, (3) £2,500. Half the money only is wanted for the latter scheme, the other half being promised by a local proprietor.

COD.—With the great lines 100 to 120 cod could be obtained before the fishing became impoverished within recent times. This class of fish is now very scarce.

CRABS AND LOBSTERS.—Some contradictory statements were made, especially as to the destruction of soft crabs in the autumn fishing; but the general opinion was that very few hard were got among a large majority of soft. Seasonal variation in this respect evidently takes place. For instance, two years ago three-quarters of the crabs were soft; this year there are many more hard. But, with regard to the success of the fishing as a whole, the following statements were made:—

With 150 pots to-day 20 score was about the average catch; with 11 pots 45 years ago the same number could be obtained. A fisherman fishing at Newton, it was said, 30 or 40 years ago, once got so many crabs that he only retained the “claws” throwing away the bodies. One day at that time a merchant paid three men £27 at 2 6 a score for their catch. Thus each man caught say 72 score. Of course this is exceptional, but it shows that the waters near the coast were richer in crabs and lobsters than they are now. The ground is limited for this kind of fishing, and if a larger number of pots are used, as is the case now-a-days, and the time of fishing be extended to include the whole year we should naturally expect this over-fishing would have its effect. Not only are more pots used per man, but they are closer together. For both reasons the catch per pot has considerably decreased. The crabbing has been more and more developed every year, especially during the last 30 years. So much so has this been the case at Beadnel, say the fishermen of Craster, that they have cleaned their own ground and they now fish part of the year off Sea Houses at another part near Craster. The lobster fishing has likewise suffered. Twenty years ago, with 30 pots, 50 lobsters could be obtained; to-day, with 30 pots, 10 to 15 lobsters are got. The fishermen were of opinion that instead of a close time for the berried hen during a few months of the year, it should be extended to include the whole year. They mentioned, moreover, that this was not only the view of Craster but most other places on the coast.

BAIT is mostly obtained from Budle Bay.

MARKETING FACILITIES.—For the crab pots 2 cwt. from Shields costs 2/8, from Aberdeen 8/4. As in other places, the fishermen must make 6d. a stone on the average before they obtain anything themselves, that is in sending to the Midland markets. The fishermen complain, moreover, that they are at the mercy of the fish salesmen, who send them what they like. The fishermen have good

reason for knowing that what is sent is not always an honest return. When bait is got from Boston, the railway charge is very heavy.

GEAR—The twine for the crab pots is cutched and tarred; the openings are at the side; the wood is unprotected. The lines are also cutched and tarred. The herring nets and brat nets are preserved with cutch.

SEA HOUSES, 14th October.

Mr. King was chairman over a meeting of 15 fishermen. In his opening remarks he referred to a meeting which took place at the end of last year to consider the subject of the decline of the fisheries. He kindly handed me the following resumé of what took place at that meeting :—

Meeting held December 20th, 1898, to consider the present aspect of the in-shore fishery (by cobbles)—present, Sir Edward Grey, Bart., M.P., and others.

The fishermen present were firmly of opinion that trawling caused great destruction of small and immature fish, besides breaking up the rearing and feeding grounds.

Of late years haddocks, the main staple of our white fishing, have fallen off greatly. From 1880 to 1885, from October to Christmas, cobbles made as much as from £70 to £100, this year £15 may be set down as the average earnings in the same period.

It was also definitely stated that trawling, even outside the three mile limit, interfered with successful herring fishing unless trawlers lifted their gear when close to boats having herring nets shot. The usual distance that cobbles go to sea before shooting their lines is hereabouts from 7 to 10 miles from the shore.

It was also considered that the present three mile limit was utterly useless so far as our in-shore fishermen were concerned: from 8 to 10 miles seemed a fair thing. The prevalent opinion was, that having supreme authority, gun-boats would enforce the law as regards the present limit very much more effectually than any local force, and on conviction heavy penalties should be laid on the transgressors.

Another matter was discussed: it was shown that in-shore fishermen could not very much farther develop their present ways of fishing, whereas every year improvements are made in trawling, *i.e.*, by length of beam, which means raking up more ground. In short, unless vigorous efforts are gone into, in our neighbourhood

the in-shore fisherman will have to abandon his present means of making a livelihood. Complaint was made also of the difficulty of keeping trawlers outside the three mile limit.

The herring boats at Sea Houses number nine. During the herring season a large number of strange boats, principally from Cornwall and Scotland, bring the numbers crowding into the harbour to 50 or even 100 at times. The nine boats give employment to 54 men, including a few half-share men, not local fishermen. There are 14 cobs, only 8 of which, however, are used in the summer. Rather more than 50 fishermen, it might be said, are thus employed at Sea Houses. Mr. Ewing, the others assenting, said that the men, as regards numbers, had remained pretty stationary, but during the herring season 40 years ago there were as many as 52 local herring boats, smaller than those at present in use, employing five men a boat. These boats were manned to a large extent by half-share men who followed for the rest of the year other callings altogether such as tailors, shoemakers, agricultural labourers, drainers, etc.

The herring boats which are falling into disuse are not being replaced, and some of them are now not fit to use and this will consequently make the number less for next season. Mr. Ewing gave also some very interesting information in regard to the condition of the fishermen in the past. He said the fisherman was much better off. If he had fewer nets, these were well made from twine spun by the women. They were stronger and were not so liable to be damaged as is the case now. The net then was 35 to 40 yards in length and 16 went to form a "fleet." To-day the cheaper nets are 40 to 60 yards long and 55 go to a "fleet." It thus needs more gear to-day than before to catch herrings.

KINDS OF FISHING.—The herring fishing is from July to the third week of September. Mr. Ewing and others seem to think the season is contracting, but this year and last year the season has been later. The 7th October is the latest date known for the landing of herrings at Sea Houses, and that was 55 years ago, but it has been approached to in more recent years. The line fishing is from the second week of October to the latter part of February. The crab and lobster fishing used to be restricted to the period between February and the beginning of the herring fishing, but now the destructive autumn crab fishing is becoming more and more common. Eight cobs were employed at it even during the

herring season this year—I suppose manned by those not able to get boats and gear to go to the herring fishing. The Sea Houses fishermen say that the Beadnel men come north in the autumn and go south in the spring, there is no recognised boundary.

Here, as elsewhere along the coast then, with the diminution of line and of herring fishing, there has been an increase in the crab and lobster fishing to the detriment of the latter.

Trout fishing is indulged in to a slight degree. No license is required, but there are few fish.

HADDOCK FISHING.—As Mr. King's evidence shows, this has greatly decreased. I was told that with 1000 hooks the average catch for four days recently was 15-19 stone of haddocks, codling, plaice, and dabs. The number of haddocks would be about 97 in such a catch. Fifteen years ago 100-120 per boat with a less number of hooks could be got. The fishermen, as has been seen from the evidence of Mr. King, point out the great destruction of small fish by the trawlers. The fishing ground is much the same, but close to shore, about one mile off, is very regularly fished now-a-days, while four miles out used to be the best place.

CRABS AND LOBSTERS.—The fishermen are quite convinced of the necessity for a close time for the "berried hen," and would welcome a bye-law prohibiting the taking of the "berried hen" at any time and all times. The lobsters have very much decreased in number. The ground fished upon is, of course, very much more extensive. The pots, 24 years ago, were 18 fathoms apart and separate; now, in fleets they are placed 10 fathoms apart.

HERRING FISHING.—The trawlers, as before, are said to prevent the net fishermen getting on to the ground, and do not yield to the "drifters." As many as 15 were seen trawling around on one ground. The trawlers are blamed for breaking up the shoals and destroying the spawn of the herring.

The bait is obtained from Budle Bay as at other places mentioned, 22 baskets going to the ton.

Railway rates, as at other places, were said to be too high, and for the same reasons.

BEADNEL. 17th October.

The Vicar (Rev. C. F. Thorp) was chairman. There was an attendance of 22.

NUMBER OF BOATS AND MEN.—The herring boats as at other places are now larger. There were 6 boats this year, employing 36 men. Thirty-five years ago there were 22 boats employing 4 to 5

men each, half-share or hired men eking out the number of local fishermen.

COBLES.—Eleven boats with 4 men each now; 30 years ago there were 3 men to the boat.

The number of fishermen may be said not to have decreased. They are as numerous to-day as within recent times at anyrate.

HERRING FISHING.—July to near the end of September, all the boats working at Beadnel.

LINE FISHING.—October to February. There has been a gradual reduction in the number of boats engaged in line fishing during the last 12 years. At present there is only one boat at the haddock fishing, but others will go to obtain bait for their crab pots. In the month of April, however, they send to Shields and Aberdeen for bait, a sufficient quantity not being procurable locally.

CRAE AND LOBSTER FISHING.—January to June was the regular season, but only one boat is making an attempt to observe to some extent this old rule. The others fish with creels all the year round practically, the herring season being the only interruption.

SALMON AND TROUT FISHING.—April to September 1st; no license is required. June is said to be the best month. The catch is mostly trout, but salmon and grilse are also got. The restriction of the close time is considered a hardship.

HADDOCKS, &c.—Boats fishing with 4 lines of 1000 hooks each, baited with mussels or mussels and limpets, got last year 5 to 6 stones of codling and haddocks, other boats obtained very much less; 12-24 years ago a boat with 4000 hooks obtained 40-50 stones on the average, consisting mostly of haddocks, with cod, ling, a few halibut and skate. Some got 50-60 stone, while 80-100 stone have been obtained exceptionally.

Cod and ling are very scarce now, 8 ling was the best catch last year. Instead of 20 or 30 cod which used to be got in the above catches they are now very few indeed. Halibut are scarce also. Whitings were never common here.

Plaice used to be obtained, but the fishermen say the trawlers have "cleared them out." Three half-lines on the north bank would catch 30-40 stone of large plaice during February, March and April, but now-a-days when lines with 300-500 hooks are put down, very few fish indeed are obtained. Even plaice of a middling size, which used to be common, are now not to be had.

DABS are not so numerous either. They used to be common in Skate Roads. Twenty stone could be obtained with say 3000 hooks; 1 to 2 stones might be said to be the catch to-day.

Mr. Douglas pointed out to me that the cormorant and shag take a heavy percentage of flat fish in the young condition such as plaice and turbot. He has watched one of these birds eat 9 flat fishes of 4-6 inches in a few minutes, and thinks, therefore, that the Wild Bird Protection Act is not altogether a blessing from the point of view of the fisherman. The North Sunderland men have got many flat fish, including soles, for their crab pots on the Megstone, where the cormorant breeds. This is not the first time that the cormorant has been blamed for taking more than a fair share of fish. Mr. Hancock, in the interesting introduction to his "Catalogue of the Birds of Northumberland and Durham," gave extracts from Newcastle Municipal accounts supplied to him by Mr. Clephan, which showed that the Tyne cormorant at one time, (1561-1654), had a price set upon his head.

CRABS.—Forty to fifty pots for 4 men are in use at this time of year, but 4 fleets of as many pots each are put in in the spring. When I visited Beadnel on April 1st, there were some ten boats fishing, each boat possessing say four fleets of 50 pots each fleet (the usual number being 40-60): at that time then there would be about 2000 pots in the water. The crabs are reduced in numbers and in quality. The autumn fishing is admitted by some to be very destructive.

LOBSTERS are not nearly so numerous either, now that the fishing is so widespread as regards area and the time devoted to it. The close time for the berried hen is welcomed as an excellent measure, and should be extended to include the whole year as for the crab.

FISHING GROUNDS.—The crab and lobster ground is now much more extensive both laterally and seawards.

The old spawning grounds of the haddocks, where they and other fish used to be so plentiful, are now of little use to line fishermen. The harder grounds, where the trawler cannot go, on the north side of the spawning ground, is the only place available now-a-days, though naturally more codling are caught in such a place.

BAIT is got from Bndle Bay usually.

MARKETING.—Sixpence a stone would clear railway rates and marketing expenses for fish. For crabs, 3/3 a large barrel for carriage and 2/3 for commission. &c. gives 5/6—the figure necessary to clear expenses.

GEAR.—In the case of crab pots the openings are opposite and at the sides; the net is tarred. The lines, sails, and herring nets are preserved with tan.

Turbot nets are used in August and September. This year 40 nets, in 4 fleets, only caught 1 to 3 turbot. Sixteen was the best catch, and that only once, the turbot averaging 7-8 lbs. Twenty-six years ago 16 nets in 2 fleets, captured 99 turbot as well as ling, cod, and skate. A fairly common catch 40 years ago was 40-50 turbot.

HERRING NETS.—Fifty to fifty-five nets form a fleet now-a-days. Fourteen years ago there were only 16 to 18 in the fleet.

| | Now. | 30-40 Years ago. |
|-----------------------|--------------------------------|------------------|
| Length | 60 yards ... | 50 yards |
| Depth | 18 score meshes | 15 score meshes |
| Position when fishing | 3 fathoms down and inverted | 2 fathoms down |

In the foregoing record of what passed at the conferences, I have, with very little alteration, presented the evidence in the way in which I received it. There is no doubt that the in-shore fisherman in his anxiety to run down his far too successful rival the trawler, lets himself run riot in some cases in regard to matter of fact. Where this was glaring, I have found myself drawing my pen through certain of my notes while transcribing them, but, on the whole, the reports give in considerable detail the matter as I have obtained it. Some of the points which stand out fairly prominently, and are doubtless based on fact, may now be shortly considered.

First, the in-shore fisherman is not so well-off to-day as he was only a decade or two ago. He needs more gear and catches relatively fewer fish with it.

Second. In certain of the villages, and especially in those which are near to the large towns, the number of fishermen is decreasing. The younger men in such places are quitting the fishing for such other industries as are locally available.

Third. The crab and lobster fishing, which was prosecuted with so much success from 30 years ago practically up to recent times, appears to be at the root of the difficulties. At one or two places, when the prices for crabs and lobsters were high, an increasing number of fishermen left the line fishing and began what we might call the autumn crab fishing. This was at a time (about 1870) when trawling could not be blamed for compelling them to do so. The returns in price seemed to be more attractive

in crab than in line fishing, and the change was thus a voluntary one. Other places and other men followed this example and for the same reason. More gear, after some years, was found to be necessary. But even with that to-day the fishing is not so productive, and especially in the autumn or end of year fishing—a very unprofitable one—so that we are finding some of the fishermen again voluntarily going back to the line fishing and many others willing to do so were it not for their neighbours. The returns in price again, are, as the fishermen confess themselves, not so good as formerly. The gear is expensive and does not last very long. Besides, storms sometimes cause a great deal of loss during the autumn. The fishing itself is very bad: so many soft crabs are got in the pots that even with much care of selection those sent to market are so inferior that the merchant in many cases refuses to have more sent to him. It is the time of year, moreover, when the deterioration, which is admitted, takes place. I believe, in fact, the time has come for imposing a close time, including the months of October, November, and December, as well as for protecting the “berried” lobster for the whole year.

But (fourth), the difficulty is, could the fisherman as profitably at least, spend his time at the white or any other fishing but crab and lobster fishing? No one will doubt from the evidence which has just been presented that the haddock fishing has deteriorated; and can we therefore, in the face of these facts, recommend closing the kind of fishing, so many of them at present prosecute if only with a fair success, for three months of the year. Several intelligent fishermen to whom I have stated the problem, have replied that the line fishing during that period could not be worse than the crab fishing. They have never fished for white fish to any large extent during these latter months of the year—at least at the northern places, where the restriction suggested seems to be more desired. The herring and the pot fishing has served to take up their time entirely. The latter, they are realising, is seriously threatened. It is admitted that the white fishing is not in a satisfactory state for line fishermen, but I am persuaded that the fishermen for these months in the year would make as much, and perhaps more, with their lines. Some prefer to do so voluntarily, and the necessity for a close time is so great that the others should be compelled to follow suit.

Fifth. If the round fish have decreased on the grounds accessible to the in-shore fisherman, the flat fish seem to have still

more decreased in numbers and in quality. Trawlers say there is no doubt that plaice have become very scarce not only near the coast but in the North Sea generally.

Sixth. In the case of the crab and lobster, we can make an attempt to improve our local fisheries by putting a stop to fishing during a season which has been proven to be a very destructive one, and also by protecting the "berried" females. But it is quite manifest that measures which may be suggested for the improvement of the white fishing bring us into touch with a difficult economic and international problem. We do not possess the necessary facts in regard to the life-histories, migrations and spawning places of the fishes concerned to clearly indicate a solution. But suggestions have been made from time to time as to regulating the size of the fish which may be landed, extending the limits the North Sea powers have under their jurisdiction, imposing a close time during a part of the spawning season of the more important fishes, the establishment of hatcheries and so on. Were it a question of recommending the best method of fishing, the simple solution would be, to advise the ordinary fishermen to give up the old method of fishing with the line which offers so little hope of improvement, and to take up trawling. As an instrument of capture there can be no two opinions as to the efficiency of the trawl, and especially when it is worked from a steam vessel capable of fishing at any season and in all weathers. Or we might recommend the fishermen to join together in manning steam liners, a class of boat which can compete very successfully with the trawler. It may come, now that steam is being more and more used in connection with the herring fishing, that our in-shore fishermen will be drawn into the more successful, or let us say into the modern methods of fishing, and if the younger men became attracted to entering trawlers, such a change would be bound to be hastened. But on the other hand, we have to remember that steam requires capital, and that the fishermen in passing from their own well-known industry to that of trawling, become more sailors than fishermen, and lose an independence which is one of their most characteristic qualities. Indeed it is my belief that fishermen when they leave in-shore fishing as an industry to take up some other means of making their livelihood, do not in many cases become trawl fishermen. This is a point, however, upon which some definite information would be very useful. It is not likely then, that the change, if it does take place, will be a rapid one, and the effects upon the population of

our coast may therefore, in the meantime, not be contemplated. The majority of our line fishermen, and their descendants for some time to come, at any rate, will still try to make the best of their limited means of making a living. The fisherman is a specialist, but the life-brigade and the life-boat offer a change to his energies. It may be possible to suggest some other local industries which while adding to his income, would allow him to carry on his fishing, and if these are allied to fishing so much the better. Such local outlets for his energies will still further tend to keep off a day when one could write that all fishermen are trawlers.

But if the fisheries are suffering from over-fishing now, they would not be likely to be any better, but a great deal worse, if all the energy which is now expended in fishing were put into this one form of fishing. And that is just the question to which we want an answer. Are the fisheries being depleted? Does the evidence I have just given support the contention of fishermen and others that the North Sea is being fished beyond its resources, or are the nearer grounds, at least which the in-shore fisherman can reach with his boat, suffering from over-fishing?

It is not set forth with a claim to its being a conclusive statement, but as a contribution to the facts, or rather want of facts bearing on the question. Our trawling experiments afford evidence likewise, but for reasons I have already given, we are not yet in a position to put the statements of the fishermen and our experimental results together.

The best contribution would be reliable statistics, and if they are worth having at all, they ought to be as accurate as possible. It is to be hoped, also, that the international Conference, recently held in Bergen will be the means of bringing about such a vigorous hydrographical and biological investigation of the North and neighbouring seas that the local facts and figures will gain a significance, now not quite clear, and lead to an international effort to keep up, or as seems to be necessary, to restore the North Sea Fisheries.

SEVENTH.—The principal change in regard to the herring fishing as far as the villages along the coast are concerned, is that fewer fishermen now prosecute this form of fishing. That it is still lucrative, if variable is shown by the fact that large fleets follow the advent of the different varieties all round the coast: and that steam is being more and more introduced to make the fishing still more effective.

It seems desirable that some definite arrangement should be come to, to prevent the competition on the grounds between net and trawl fishermen. I believe in the south, steam vessels of all kinds are obliged to yield to boats using drift nets, and it would be no great hardship to enforce such a rule here. But it is much harder to point out how the net fishermen can gain access to the grounds if such are already in possession of trawlers. Were it quite clearly proven that trawlers caused the damage which it has been said they do, or admitting the damage, were it shown that consequently the herring fishing was suffering, some legislation having for its object the reservation of certain fishing grounds might be suggested. But the case is yet far from being in this condition.

EIGHTH.—Complaint is made in regard to the close time for trout and salmon fishing, and however difficult it is to please everyone with regard to such a subject, it seems fair that an effort should be made to make the close time the same for the whole district.



SOME OF THE MUSSEL BEDS ON THE
EAST COAST OF SCOTLAND,
AND THE
DESIRABILITY OF FORMING MUSSEL BEDS
ON THE COAST OF NORTHUMBERLAND.

In connection with the recommendation which has just been made for imposing a close time for crabs, and the making the line fishing of as much value as possible, comes the question of supplying the fishermen with bait at a low rate. I have already in previous reports tried to draw attention to this subject. And this year with a view to getting some experimental beds laid down at different places on the coast where the mussel would be likely to establish itself, and furnish a supply of bait, I made enquiries in regard to a number of places, visited some, and when in Scotland this summer took the opportunity of seeing the more important mussel beds on the east coast, and of interviewing the owners and managers.

It is unnecessary to refer to what I saw in detail, for an excellent account of the mussel beds and their management may be found in the Report on the Condition of the Scottish Mussel and Bait Beds (1889).

The main difficulty in dealing with the question of the laying down of beds or improving existing ones is a legal one, as has been pointed out in previous years. I was desirous, therefore, for one thing to find out how the Scottish beds are protected, and the information I obtained on that point as well as the general notes I made I shall now give.

YTHAN MUSSEL BEDS.—I did not visit the beds, for my time in Aberdeen was very limited, and besides I had some nine years ago, an opportunity of seeing generally the mouth of the Ythan. I was, therefore, able to follow the description which Mr. George Davidson, of Messrs. G. & W. Davidson, kindly gave me in his office in Aberdeen. The beds are leased from Mr. Udny, of Udny, together with the salmon fishing, and they have been in the possession of the Messrs. Davidson for over 100 years. The sides of the river are

only available, for the pier is so high up that the channel which would otherwise be valuable for cultivation is taken up by steamers trading with Newburgh. The spat is collected at the mouth of the Ythan, and removed to suitable places at the sides of the river below the pier. Above the pier the mussels do not grow satisfactorily. The small mussels are removed in the spring and autumn and the mussels are usually not moved again, for the strong tides often sweep away the large ones, and even if they do attach themselves, they do not grow so satisfactorily as those in situ. Colliston and Newburgh fishermen enjoyed until lately the free use of the beds for a yearly rental. The former paid £4 a year, and the latter £3 a year per man. This arrangement now no longer exists, and the mussels are sold at 5d. a peck, Messrs. Davidson's men doing all the work connected with the beds. In his evidence to the Scottish Fishery Board Committee, Mr. Davidson said that 100 pecks would make a ton. This comes to over £2 a ton which is a good price compared with other places. Occasionally a portion of a bed is offered at a fixed sum. Mr. Davidson complains that the demand is declining. The principal natural enemies are the birds, which he says take a large share. As regards protecting this bed, they used to fine fishermen themselves for poaching, but they have not had to do so for many years.

MONTROSE MUSSEL BEDS.—The importance of these beds as an object lesson in the use to which an immense tidal basin can be put, cannot be overestimated. In the report of the Committee on the Scottish Mussel and Bait Beds, the following summary is given of the evidence, "From that evidence, it appears that ground on which 'prior to 1853 there were no mussels,' now yields annually 'about 14,000 measures,' *i.e.* about 600 tons. It further appears that a considerable extent of ground which already produced mussels is made to return greatly increased crops by the adoption of a thorough system of sowing mussel seed, transplanting the growing mussels, and keeping the beds in the best possible order by allowing them occasionally to scour." It was easy to see here as elsewhere the immense importance of getting the bank as level and as much under water as possible, so as to give the bivalves the best chance of keeping their position, and constant or almost constant feeding.

The "seed" when it is gathered in the channel, and usually well down below the bridge is said to be two years old. It is placed on the banks and requires other two to five years to attain a saleable size. The five years period is the usual one, and gives the principal supply.

For taking the mussels on the beds, and for getting the small mussels in the channel, rakes are used. For bank work the rakes have a 16 feet shaft. The iron T piece bearing the teeth is bent round at each end, and again to form the terminal tooth. An iron hoop connects it and the shaft, and between these a net is stretched. There are seventeen teeth altogether, seven or eight inches long, at intervals of two inches. For channel work the shaft is longer—22 feet.

The principal natural enemies are the “cross” or “star” fish, and the “white buckies” or “dog whelk.” The ground is leased from the Dun Estate for £500 a year.

The banks on the north side of the Esk are leased by a remarkable, and at the same time, a most successful association of fishermen, whose origin for the purpose of providing themselves with bait, is evidently due to the Messrs. Johnston, likewise. They paid £100 to the proprietor until recently, but Messrs. Johnston, I understand, have now bought the ground, and the rent will now be paid to them. By thus co-operating the fishermen of Ferryden and Usan, obtain mussels at a very cheap rate.

In both cases the seed is obtained from the river, and carried up to the bed selected, being usually deposited “on the top of high water,” and the mussels are usually transplanted into deeper water at a subsequent period.

The right has never been a matter of difficulty at all. The mussels are not interfered with. But the fisher people—women especially—do a great deal of harm often gathering “wilks” (periwinkles). In gathering the periwinkles, they tread down a great many mussels, but the Messrs. Johnston have so far only threatened to take them to court, or have occasionally taken the periwinkles from them.

EDEN MUSSEL BEDS.—The banks on the south side of the river belong to the town of St. Andrews, those on the north side, the “Leuchars beds” to private owners. Both are of considerable extent. The river is very deep in one part opposite the beds, but on the whole spat settles well in the channel, and, unlike Montrose, it is allowed to grow there to bait size. The rest of the spat is taken from the higher and shoreward parts of the banks, at 2-3 years old, and removed to suitable places near the channel where it requires $2\frac{1}{2}$ -3 years before it reaches a bait size. The sales fluctuate according to the state of the beds, as may be seen in the evidence of the Manager to the Government Committee. This year they had reached up to

the time of my arrival about £700, which I think is about the best sum yet registered for these beds. Twenty-two baskets are sold as being equal to one ton, but one basket is assumed to be one cwt. The basket is heaped, and the charge is 1/- per basket to strangers, but St. Andrews' fishermen have only to pay 10d. St. Andrews' fisher girls are allowed to gather periwinkles without restriction.

The fishermen of St. Andrews used to have a free use of these beds, but since the town assumed the right, the fishermen do not interfere. A prosecution was once made—for destruction of mussels and mussel spat. But here again the right is a simple one, the town holding the beds for the community of St. Andrews, and the right is not interfered with, and the beds are not poached upon. There is not now such a demand for bait at St. Andrews.

The bouchot system has been tried in several ways at the Eden beds, but with no success.

As the fishermen themselves in many places are crying out about the necessity for a close time for crab and lobster fishing, and as the months which seem desirable for this are months when white fishing may be best prosecuted, there is no doubt that the efficacy of the white fishing will be much enhanced by an adequate and cheap supply of bait. The necessity for it I have before written about, and there is now nothing further to be said than that the establishment of such beds is a matter of the greatest importance for the maintenance of our fisheries.

Bait is at present supplied at a cheap rate from the mussel farm at Budle Bay, but the yield is limited, and fishermen are obliged to send often to a considerable distance for mussel bait, and pay a heavy carriage in consequence. Much of it, indeed, comes to Blyth and other ports from Germany.

The experiment ought to be made, at least, to grow mussels on such places as may be selected with the concurrence of the owners; for I should imagine that all the places in our district which might be available for mussel cultivation will be claimed by private owners.

But Mr. Dent's experiences on the Blyth, and the poaching which takes place in other places with reference to bait, shows us that it is essential for even the success of our proposed experimental beds, either to have the claims of the owners or their tenants defined and established, or to protect the beds and bait in general by a bye-law. Under the Sea Fisheries Regulation Acts, 1888 to 1894, the Northumberland Sea Fisheries Committee has the power to regulate,

protect and develop any shell-fish fishery. I beg to hope, therefore, that the Committee will frame and pass such a bye-law with the approval of the Board of Trade—a bye-law which will have for its aim the regulation and protection of all kinds of bait or other shell-fish which may grow or may be cultivated within the district. Were this done, it would be possible for the owner, the tenant or the Committee, or the fishermen once their claims were registered and admitted, to prosecute anyone interfering with the beds.

It may not be altogether premature in merely making the suggestion to point out that it would be necessary as far as protection is concerned, (1) to prepare a list of existing claims to bait, and to add to the list such new beds as may be laid down, (2) to allocate the bait ground along the coast claimable by each fishing community; the bye-law framed with the concurrence of the owners of the several fisheries would afford a protection to both classes.

With regard to regulation, the bye-law should provide for the Committee being allowed (1) to prohibit the taking of mussels below a certain size, (2) to prohibit the taking of mussels at certain times, or for purposes other than fishing, (3) the defining of what beds or parts of beds may be used. This regulation would not always be desirable, but it would give the Committee the power to interfere if the beds were found not to be developed to the extent which might be expected.

In this connection a word may be said about the development of tidal flats in general.

DEVELOPMENT OF TIDAL FLATS.

Our coast is not remarkable for its tidal flats. It consists of a pretty strait line of alternate rocky and sandy shores. But there are one or two places at present little better than waste, which on enquiry and investigation might be found to naturally support some form of molluscan life. Some of these, besides the mussel, might be encouraged by cultivation to yield in large measure a food, which, if a sufficient guarantee of purity and freedom from disease could be given, would not be difficult to introduce as a food resource. Experiment in this direction is much required. For example, it is known that a tidal oyster, until quite recent times grew well and spat at any rate to some extent at Warham and Fenham flats. Indeed there is still a place in the stream of the latter place, which is known as the oyster scarp, and on which a number of oysters are successfully “filled,”

and kept until required at the instance of the Earl of Tankerville. An oyster pond in connection with Mr. Brown's mussel farm, at Warham, is used for keeping oysters until required in similar manner. I am led to understand that the native oyster is still to be got on the Fenham scaup. And, of course, the shells of this natural oyster inhabitant are quite common on the shore near the scaup, and may be got at Warham. If it be the case that this native oyster is not altogether exterminated, and I believe that it used to be taken away by coasting vessels in large quantities, it might with a little care be re-established and furnish profitable work for the fishermen of that region. The mussel we have seen grows naturally at Fenham in considerable quantity, and in the cultivation of this species again much valuable work is apparently available. The cockle and the clam (*Mya arenaria*) are also native to this place, and to Warham, and might be cultivated and introduced into the markets as a good, if less noble food for human beings. I can imagine that if such were established and shown to be capable of successful cultivation, that methods of cooking in various different ways would become an important investigation in the process of introducing them to the public.

There are several other places which experiment may prove to offer the desired facilities for providing mussels for bait. So that, if our coast does not present much waste ground which might thus be brought into requisition, we can at least make the attempt to make the best use of what little there is. I cannot think of more suitable experimental work for the Technical Education Committee after trying to find out and make known the local condition of the sea fisheries, than endeavouring thus to bring under cultivation such places as now seem to be of little use to anybody, and the very fact that the clam would require to be dug, would make the work look still more like the better known cultivation of the land.



NOTES FROM THE MARINE LABORATORY.

HATCHING WASTE OVA.—In February a series of glass vessels were prepared for carrying on the experiments in hatching which were referred to in the report for last year. Neither the fishery officer nor the late laboratory fisherman were able, however, to get any material worth reporting upon for making experiments. Two boxes of bottles were sent to Shields with instructions; one of these was returned empty, the other has not yet been sent back. The fisherman did make an attempt, however, and obtained a quantity of cod's ova from a fish just about ripe and attempted to fertilize it on the 22nd March. The fish were caught on the 20th; on the 28th the eggs were all found to be dead, and evidently not fertilized. This goes to show at anyrate that the period that may elapse after the death of the parent fish to ensure success in hatching must be less than two days. The fisherman again, on April 1st, got some spawn from a live trawled cod but did not manage to get it fertilized. I visited North Shields myself on the 20th of the same month, but could only find spawned fish.

On account of the interest which the problem has awakened and its practical bearing, I hope that we shall be able to make experiments enough early next year to report fully as to the conditions which limit utilizing the waste ova of the markets.

CRABS.—On October 28th, 1898, eight female crabs were sent from Beaduel, by Mr. J. Douglas. Four were dead on arrival. One was found to be fully "berried" on November 3rd, but it died on November 7th. Another of the crabs, also found dead on the 7th, had commenced to spawn: there were a few patches of ova on the tail. The remaining two crabs were then separated, one of these was found on November 26th to have deposited her spawn in a corner of the tank, which was a very curious action indeed, if a disappointing one. The two crabs were kept until 24th March, when both were found dead. Both presented spawned ovaries. The last one, therefore, appears to have been a female which had hatched out in the summer of 1898, and would not have been ready to spawn until the end of 1899. The two crabs which spawned normally and the third which deposited her ova in such a curious manner, go to show then that the spawning period for this species begins in November.

On 27th May, a "berried hen" crab was brought in from the pots at Cullercoats. Her tail was immensely distended with the "berries," and she assumed in the tank some very curious positions to accommodate the heavy burden of eggs depending between and behind her walking legs. She died on 6th July. The embryos measured $\cdot 51$ mm, and were evidently nearly ready for hatching. The whole mass might be reduced to a right-angled triangle, the sides measuring 60, 70, and 100 mms, and the transverse measurement is about 60 mms. If we express these measurements in cubical contents and divide by the cubical mass of the egg, we should get approximately the number of eggs. In a rough determination, using the diameter of the egg as the side of a cube, the number of embryos appears to be rather more than 1,000,000.

On 1st April, 1899, I visited Beadnel and was glad to find that Mr. Douglas had been keeping a number of female crabs in closed boxes—small hullies made of herring boxes with lids, wedged into crevices in the rocks. In one hully he had the following females:—Three in spawn which spawned in December, one in spawn which spawned in January, one in spawn which spawned, though not completely, in November. In the same box was a female which was marked in March, 1898, put into the water just off Beadnel, and was caught again in August two miles north-east of the place where it was put down. This is a most interesting crab, for she has thus been under observation for a year, and during that time she has not been in "berry" nor has she cast.

When I visited Beadnel next, on 7th September, Mr. Douglas recounted to me the fate of the crabs. Those which spawned in December hatched out in the first week of August and died about the end of the process, the deaths being due to the very hot weather of that time and the exposed position of the hullies. The November spawner hatched out early in July, no more "berries" having been added. The crab which spawned in January died in July before hatching. The marked crab referred to above died also in August, no change having occurred; no berries had appeared on her tail and no berries were visible when she was opened.

Mr. Douglas' son marked a berried hen crab in March and put it into the water three miles from shore. She was caught again in the latter part of July, quarter mile or so from the shore, and was then "clean" hatched. Four or five years before a crab was caught in spawn in July. She was marked and returned to the

water quarter mile out. She was got again in August a mile further out and found to be "clean" hatched. A fisherman at Sea Houses told me that some crabs were placed in a box in the harbour in December and a week or two later there were several of them berried.

All this goes to prove what Dr. Gregg Wilson pointed out for this coast some years ago, that the spawning period for crabs is November to January. It shows, moreover, that the crabs which come into berry in these months hatch out in the following July or August. The period during which the berries are carried by the female is thus 7 to 8 months, and we must thank Mr. Douglas for the experiments and observations which enable us to make this statement. Thus the scarcity of males in July and August is due to the fact that pairing is taking place during these months, and the soft females and the males may then be got in holes and crevices of the rocks near low water mark. Mr. Douglas told me for example that on 14th August a catch of crabs consisted of 3 males and 107 females. As Autumn advances the males become more numerous, as was pointed out in last year's report, and the fishing becomes very destructive from the considerable predominance of soft crabs, and the small number of hard including the females which are just about to spawn. Many of the fishermen at Beadnel and Sea Houses would favour a close time from October 1st to December 31st, for they are beginning to realize that they are killing the goose which lays the golden eggs. This overfishing has already been referred to in the report on the conferences. I need only add here that the time is ripe for passing a bye-law making it illegal to fish for crabs or lobsters during the months of October, November, and December. I am convinced that the fishing during these months is very destructive and of no great value to the fishermen themselves. The gear is very dear comparatively, and the proportion of the catch which is marketable is so small that no hardship whatever would be felt. Were this done and the close time for the berried lobster extended to the whole year, a marked benefit would be bound to be felt in a very short time.

With a view to repeating and extending such observations I have arranged to get a tank made on the rocks off Cullercoats. This will be ready for the ensuing spawning season.

Mr. Douglas and Mr. Fawens, Sea Houses, have been keeping a record, in books I have provided for the purpose, of their catches

of lobsters and crabs, but I do not propose reporting upon them until next year. I should be glad to send books to fishermen who may be willing to thus give us most useful statistical information.

LOBSTERS.—A berried hen which was caught a half mile off Cullercoats was brought into the laboratory on April 10. She started hatching about 24th June, and the process continued for some days. She was found dead on 4th July, and the abdomen was then entirely free from the embryos. The embryos themselves were all found to be dead in the tank.

Another female lobster was brought in evidently after hatching, and she cast her shell in the tank during the night 17-18 August. This is, of course, the time that a large number are found soft. The laboratory fisherman told me that this year in August he found a soft lobster in a hole in the rocks, so soft that he dared not lift it; when he went back a fortnight after she was gone. The lobster referred to above as having cast her shell, was found to be apparently quite hard on the 26th August, so that the hardening appears to be a relatively quick process in the lobster.

In a second hully at Beadnel, Mr. Douglas showed me two berried lobsters on 1st April. These died like the crabs in August, but one was nearly hatched out in the end of July.



A STUDY IN PLANKTON.

This year the comparative results in a series of Plankton determinations in a quantitative sense were so striking that I photographed the bottles containing the material together as the best means of demonstrating them. These were made as will be seen between the 19th and 23rd June, first at Cullercoats on the southern part of the Northumberland coast, and in the case of the others in the neighbourhood of the Farnes and Holy Island in the northern part of the district. The dark contents represent the catch for about an equal time on each occasion, and the variable quantity of surface and mid-water life obtained is quite apparent.

The general character of the contents may be briefly stated:—

1. Cullercoats, surface, 19 June.

Egg of gurnard—one.

Medusoids: *Thaumantias*, several.

Sarsia tubulosa, Sars, several.

Copepoda: *Calanus finmarchicus*, several.

Acartia longiremis, very numerous.

Cladocera: *Eradne nordmanni* and other Cladocera, numerous.

2. Skate Roads, surface, 21 June.

Pelagic ova, numerous.

Weever, *Trachinus ripera*, say 70.

Gurnard, *Trigla gurnardus*, say 10.

Five-bearded Rockling, *Onos mustela*, say 30.

Copepoda: *Calanus finmarchicus*, numerous.

Anomalocera patersoni, several.

Temora longicornis, very common.

Pseudocalanus elongatus, common.

Centropages typicus, several.

Oithona spinifrons, several.

Cladocera: *Eradne nordmanni*, common.

Pleopis polyphemoides, very common.

3. Inner Farne, mid-water—near bottom, 22 June.

Pelagic Ova, none.

Beroe and medusoids (principally *Thaumantias*), numerous.

Copepoda: *Calanus finmarchicus*, numerous.

Temora longicornis, ,,

Acartia longiremis, ,,

Pseudocalanus elongatus, several.

Cladocera: *Eradne nordmanni* and *Pleopis polyphemoides*, numerous.

4. Inner Farne, surface, 22 June.

Pelagic Ova: Gurnard, *Trigla gurnardus*, three.

Beroe and Medusoids, as before.

Copepoda: *Calanus finmarchicus*, numerous.

Temora longicornis, very common.

Acartia longiremis, common.

Cladocera: Very common, as before.

5. Goswick Sands, surface, 23 June (morning).

Pelagic Ova:

Weever, *Trachinus vipera*, 54.

Dab, *Pleuronectes limanda*, 2.

Five-bearded Rockling, *Onos mustela*, 12.

Copepoda: *Calanus finmarchicus*, several.

Acartia longiremis, common.

Temora longicornis, common.

Cladocera: *Pleopis polyphemoides*, common.

Polyzoa: Cyphonautes larvæ, several.

6. Skate Roads, mid-water (net attached to beam of trawl), 23 June (afternoon).

Pelagic Ova:

Weever, *Trachinus vipera*, 4.

Copepoda: *Pseudocalanus elongatus*, common.

Acartia longiremis, common.

Temora longicornis, several.

Harpacticus chelifer (one only seen).

Calanus finmarchicus, fairly common.

Centropages hamatus, fairly common.

Cladocera: *Pleopis polyphemoides*, very common.

7. Skate Roads, surface, 23 June.

Pelagic Ova:

Weever, *Trachinus vipera*, 12.

Gurnard, *Trigla gurnardus*, 2.

Five-bearded Rockling, *Onos mustela*, 6.

Copepoda: *Temora longicornis*, very common.

Pseudocalanus elongatus, common.

Acartia longiremis, common.

Cladocera: *Eradne nordmanni*, common.

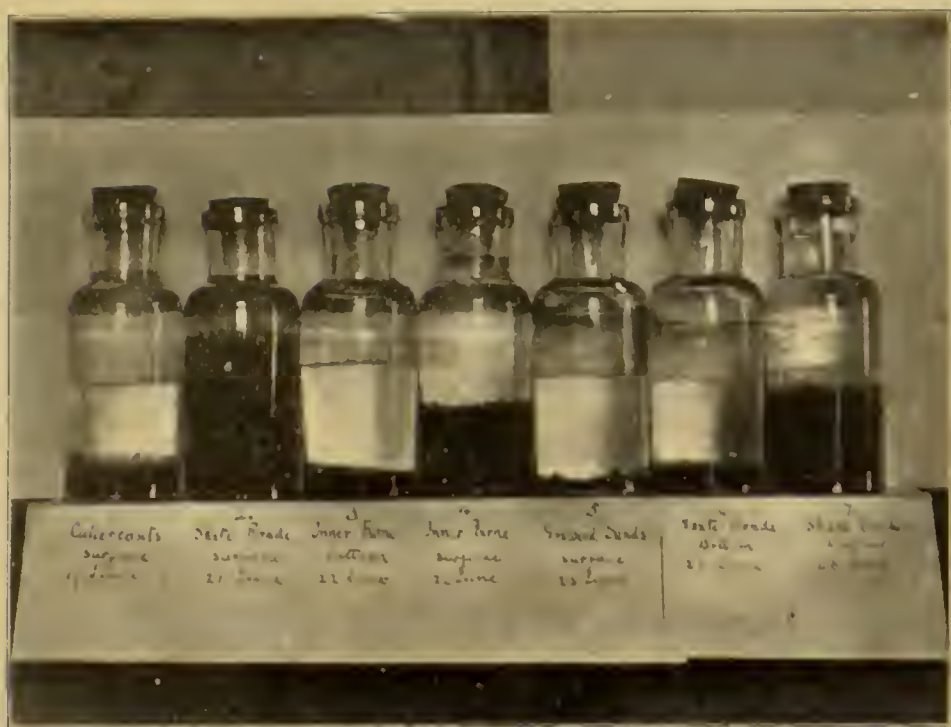


Fig. 6. A STUDY IN PLANKTON.

Perhaps the most interesting contrast as seen in the accompanying figure (fig. 6) is that between Goswick Sands (5) and Skate Roads (7). There was a small catch at Goswick Sands, but it was relatively rich in pelagic ova. In the large quantity of material at Skate Roads, fewer eggs were obtained. These results were obtained on the day which furnished the disappointing catches of fish referred to in the report on the trawling excursions; and show if the fishing was equally bad on both sides of Holy Island, that the floating life was rich in Skate Roads to the south of the island, and relatively small in quantity at Goswick Sands on the north of Holy Island.

It will be seen, also, that the surface life at Skate Roads had changed but little in quantity from the 21st to the 23rd June, but a reduction in the number of pelagic ova had taken place, and certain changes also in relation to the species of Crustacea.

The great quantity of plankton at the surface as compared with that near the bottom is shown in the bottles marked "3," "4" and in "6" and "7."

I have to thank Dr. Brady for confirming the above lists of Crustacea, and adding species I had overlooked.

During the summer, the plankton on the coast became rich in

the usual larval forms of Crustacea, Echinodermata, Mollusca, &c. A beautiful pink Appendicularian was taken twice off Cullercoats, and at the first excursion of the Northumberland Coast Club, I was glad to find the *Actinotrocha* larva of *Phoronis*. It is interesting to note that while I got only one specimen, Dr. Brady, who was also using a surface net, but a fathom or so deeper, obtained a large number. *Cyphonautes* larvæ were very numerous during July and August, and also Dinoflagellate Protozoa.

In conclusion I have to say that there are many other general observations in regard to the life of the coast, which have been made, but for the main reason of want of time, it is impossible to give at present. I have much pleasure in acknowledging from my friends—R. Y. Green, Esq. and G. E. Crawhall, Esq., two guineas, which I expended in buying the following works: Cunningham's Marketable Marine Fishes, 7/6; McIntosh and Masterman's British Marine Food Fishes, £1 1s.; and McIntosh's Resources of the Sea, 15/-. Mr. Wright, of the Hancock Museum, kindly presented us with the first two volumes of Bowerbank's British Spongiadae. And our thanks are due, likewise, to the Scottish Fishery Board, and to Prof. Herdman and the Lancashire Sea Fisheries Committee for their annual reports, as well as to investigators in various departments of Marine Zoology and Fisheries for copies of their papers.

The laboratory has had added to its resources for carrying on the work of investigation, (1) a large collection of dredging apparatus presented by Dr. G. S. Brody, (2) a microscope provided with a micrometer eyepiece, (3) a rocking microtome, (4) a paraffin bath, and (5) an installation of gas. These latter acquisitions have been made through the Technical Education Committee, together with many valuable works of reference, and render possible a kind of investigation which before could not be attempted. Through the Sea Fisheries Committee, a coble has now been added to the Laboratory's equipment, and it has already furnished much valuable material for reporting upon the marine life of Cullercoats.

The accompanying report upon the molluscan life of the coast, from material collected since the establishment of the laboratory serves to illustrate the necessity for more room to form a museum for reference and display. We have very little accommodation for storing our collections, and there is no doubt a small museum would be useful as a picture of our local life, as well as a valuable aid to teaching.

A STUDY OF THE MARINE MOLLUSCA OF NORTHUMBERLAND

(BASED UPON THE COLLECTION OF THE CULLERCOATS MARINE LABORATORY).

By G. P. BULMAN.

The study of this branch of the animal kingdom has not been carried out for a time sufficiently long to enable a thorough investigation to be made. A list of those species which have been taken in the neighbourhood since the laboratory was established, with such notes as can be made as to their frequency, &c., may, however, be of some value as a nucleus around which a catalogue may be formed capable of comparison with that of Mr. Alder in relation both to vertical and geographical distribution. A list was at first attempted in which the species should be arranged according to the "zones" they inhabit, but this was discarded owing to the great overlapping—particularly on rocky parts of the coast. The listing in a classificatory form appears to be more convenient. The names of the species are all taken from Mr. Jeffreys' work (Brit. Conch., 1862), but where these differ from those of Mr. Alder's list, the latter are also given. I have to gratefully acknowledge much valuable help from Mr. R. Howse, M.A., of the Hancock Museum in Newcastle, in determining many of the species.

PELECYPODA.

Family—ANOMIDE.

Genus—ANOMIA.

A. EPHIPPIMUM, Linn.

Including *A. squamula*, Mont., *A. aculeata*, Müll., and *A. cylindrica*, Gmel.

Not very common, in the coralline zone. One young and living specimen was found in a pool left by the receding tide on Tynemouth sands.

A. PATELLIFORMIS, var. *STRIATA*, Linn.

A. striata, Lam.

Frequent, on all parts of the coast.

Family—OSTREIDÆ.

Genus—OSTREA.

O. EDULIS, var. *PARASITICA*, Linn. (a variety of the common oyster).

O. parasitica, Thurt.

One specimen, on the carapace of the edible crab, was taken about one mile east of S. Mary's Isle.

Note.—See also present report, p. 49.—*A.M.*

Family—PECTENIDÆ.

Genus—PECTEN.

P. PUSIO, *Linn.*

P. distortus, *Da Costa.*

Common, on every part of the coast.

P. VARIUS, *Linn.*

I have only obtained one living specimen, taken with several *P. opercularis*, 18 miles off Seaham Harbour.

P. OPERCULARIS, *Linn.*

Common, in the coralline zone everywhere. They vary in colouring.

P. TIGRINUS, *Müll.*

Frequent, everywhere.

P. MAXIMUS, *Linn.* (the common scallop).

Not common, except in the north of the county, in deep water.

Family—MYTILIDÆ.

Genus—MYTILUS.

M. EDULIS, *Linn.* (the common mussel).

Common. Near Cullercoats it generally devolves, probably because of its environment, into the var. *incurrata* (*M. incurtatus*, Penn.)

M. MODIOLUS, *Linn.*

Not uncommon, on the muddy ground off the River Tyne.

Family—ARCIDÆ.

Genus—NUCULA.

N. NUCLEUS, *Linn.*

Not common.

Family—KELLIDÆ.

Genus—KELLIA.

K. SUBORBICULARIS, *Mont.*

I have only found one or two young ones in holes excavated by *Saxicava rugosa* at Cullercoats.

Family—LUCINIDÆ.

Genus—LUCINA.

L. BOREALIS, *Linn.*

Common, on all parts of the coast.

Family—CARDIIDÆ.

Genus—CARDIUM.

C. ECHINATUM, Linn.

Not common, in sandy bays.

C. NODOSUM, Turt.

Rather rare, from rocky ground off Dunstanboro'.

C. EDULE, Linn. (the common cockle).

Moderately common, in all sandy bays.

C. NORVEGICUM, Speng.

Not common.

Family—CYPRINIDÆ.

Genus—CYPRINA.

C. ISLANDICA, Linn.

Common, in deepish water on all parts of the coast.

Note.—Got occasionally in-shore at the trawling excursions. —A.M.

Genus—ASTARTE.

A. SULCATA, Da Costa.

A. danmonior, Mont.

Not uncommon, in mud.

A. COMPRESSA, Mont.

Common, in sandy bays.

Family—VENERIDÆ.

Genus—VENCUS.

V. EXOLETA, Linn.

Artemis e., F. and H.

Frequent, in sandy bays.

V. LINCTA, Pult.

Artemis l., F. and H.

Frequent, with the last species.

V. FASCIATA, Da Costa.

Not common.

V. OVATA, Penn.

I have only one specimen, taken three to six miles off Cullercoats.

V. GALLINA, Linn.

Common, in the laminarian and coralline zones everywhere.

Genus—LUCINOPSIS.

L. UNSDATA, Penn.

I have one specimen (said to come from the Low Lights, North Shields). It had probably been thrown up by a storm from deep water.

Family—TELLINIDÆ.

Genus—TELLINA.

T. CRASSA, *Gmel.*

Not uncommon, in the coralline zone.

T. BALTHICA, *Linn.*

T. solidula, F. and H.

Not uncommon, in sandy bays at and about low water mark.
This species is also found at the Low Lights, North Shields.

T. TENUIS, *Da Costa.*

Very common, in the laminarian zone in sandy bays.

Note.—As will be seen from the reports, this forms a valuable food for some of our fishes, particularly for the plaice.—A.M.

Genus—PSAMMOBIA.

P. TELLINELLA, *Lam.*

Not common, from deep water.

P. FERROENSIS, *Chem.*

Frequent, in sandy bays.

Genus—DONAX.

D. VITTATUS, *Da Costa.*

D. trunculus, *Linn.*

D. anatina, *Lam.*

Very common, in sand near low water mark.

Note.—This is a common food of the plaice.—A.M.

Family—MACTRIDÆ.

Genus—MACTRA.

M. SOLIDA, var. ELLIPTICA, *Linn.*

M. elliptica, F. and H.

Common, in sandy bays.

M. SUBTRUNCATA, *Da Costa.*

Not common.

M. STULTORUM, *Linn.*

Common, in all sandy bays.

Genus—LUTRARIA.

L. ELLIPTICA, *Lam.*

Common, in deepish water, on muddy ground.

Genus—SCROBICULARIA.

S. PRISMATICA, *Mont.*

Synedosmya p., F. and H.

Not uncommon, in deepish water.

Family—SOLENIDÆ.

Genus—SOLEN.

S. PELLUCIDUS, Linn.

Not uncommon, in deep water.

S. EXSIS, Linn.

Common, in sand at low water mark.

S. SILIQUA, Linn.

Common, with the last species.

Family—CORBULIDÆ.

Genus—CORBULA.

C. GIBBA, Olivi.

Rather uncommon, in gravel.

Family—MYIDÆ.

Genus—MYA.

M. ARENARIA, Linn.

Common, in mud at the mouths of rivers.

M. TRUNCATA, Linn.

Common, with the last species.

Family—SAXICAVIDÆ.

Genus—SAXICAVA.

S. RIGOSA, Linn.

Very common, living in sandstone at and below low water mark.

Family—PHOLADIDÆ.

Genus—PHOLAS.

P. CANDIDA, Linn.

Found very sparingly, but equally distributed with the next species.

P. CRISPATA, Linn.

Common, in shale.

SCAPHOPODA.

Family—DENTALIDÆ.

Genus—DENTALIUM.

D. DENTALIS, Linn.

Not uncommon, in deep water, everywhere.

GASTEROPODA.

Family—CHITONIDÆ.

Genus—CHITON.

C. CINEREUS, Linn.

Common, in the laminarian zone.

C. MARGINATUS, Penn.

Very common, between tide marks, and very variable in colouring.

Family—PATELLIDÆ.

Genus—PATELLA.

P. VULGATA, Linn. (the common limpet).

Common, on all rocks between tide marks.

Genus—HELICION.

H. PELLUCIDUM, Linn.*Patella p.*, F. and H.

Very common, on *Laminaria digitata*, on all parts of the coast. It feeds on the fronds of the sea-weed when young, but gradually working down the stem ultimately buries itself in the roots. I have also found it, when in its fully developed condition, adhering to the rocks like *Patella vulgata*.

H. PELLUCIDUM, var. *LEVIS*, Jeffr.*Patella levis*, Penn.Not common, with *Patella vulgata*.

Genus—TECTURA.

T. TESTUDINALIS, Müll.

Not uncommon, especially in the north of the county.

T. VIRGINEA, Müll.*Lottia v.*, Ald.?

Not common.

Family—CAPULIDÆ.

Genus—CAPULUS.

C. HUNGARICUS, Linn.

Not common. From deep water. Minute.

Family—TROCHIDÆ.

Genus—TROCHUS.

T. TUMIDUS, Mont.

Frequent, on gravelly ground, in deepish water.

T. CINERARIUS, Linn.

Our commonest littoral species, on rocky ground. In July, 1898, two young specimens of this species were found alive on the rocks in Cullerecoats Haven, which were completely decorticated. "It is very unusual for such young (living) individuals to be decorticated."
—R. Howse.

T. zizyphinus, and var. *LYONSH*, Linn.

Common. Frequently found in the crab pots.

Family—LITTORINIDÆ.

Genus—*LACUNA*.

L. DIVARICATA, Fabr.

L. rincta, F. and H.

Not uncommon, on the fronds of *Laminaria digitata*.

Genus—*LITTORINA*.

L. OBTUSATA, Linn.

L. retusa, Lam.

Very common in rocky pools. An extremely favourite habitation of hermit crabs. Very variable in colouring. The eggs are often found, at any time of the year, on the fronds of *Fucus vesiculosus* surrounded by a gelatinous fluid.

L. RUDIS, Mat.

Including *L. rudissima*, Bean, and *L. neglecta*, Bean.

Very common, on rocks and cliffs at and even above high water mark, where it is only covered by high tides.

L. LITOREA, Linn. (the common periwinkle).

Very common in some places, as at Budle Bay and Fenham Flats, but not very common at Cullerecoats.

Genus—*RISSEO*.

R. PARVA, and var. *INTERRUPTA*, Da Costa.

Including *R. interrupta*, Adams.

Common, in shell-sand.

R. MEMBRANACEA, Adams.

R. labiosa, F. and H.

R. pulla, Brown.

One specimen (dead, but not worn) was taken off Dunstanboro' in September, 1897. Mr. R. Howse says it is "probably a ballast-shell, as it is not known" (?) "in the North Sea." As Capt. Brown found it "on the sands at Holy Isle" (Br. Conch. Illns. 13, t. 8, f. 25), it may surely be included as a very rare Northumbrian species.

R. STRIATA, and var. ARCTICA, *Adams*.

Including *R. arctica*, *Lov*.

The variety is our commonest shell in shell-sand on every part of the coast, but the true species is only found with it in the proportion of 1 to 25.

Family—SKENEIDÆ.

Genus—SKENEÆ.

S. PLANORBIS, *Fabr*.

Common on sea-weeds in rocky pools, on all parts of the coast.

Family—TURRITELLIDÆ.

Genus—TURRITELLA.

T. TEREBRA, *Linn*.

Not uncommon, in deep water, in all our sandy bays.

Family—PYRAMIDELLIDÆ.

Genus—ODOSTOMIA.

O. SPIRALIS, *Mont*.

Common, in shell-sand.

Family—NATICIDÆ.

Genus—NATICA.

N. GREENLANDICA, *Beck*.

Not uncommon, in deep water on all parts of the coast.

N. ALDERI, *Forbes*.

Common, in the coralline zone.

N. MONTAGUI, *Forbes*.

Common, with the last species.

Family—VELUTINIDÆ.

Genus—LAMELLARIA.

L. PERSPICUA, *Linn*.

Not common, on rocks in the laminarian zone.

Family—APORRHAIIDÆ.

Genus—APORRHAIÆ.

A. PES-PELICANI, *Linn*.

Not uncommon, in deep water.

Family—BUCCINIDÆ.

Genus—PURPURA.

P. LAPILLUS, *Linn*. (the "dog-whelk.")

Very common, in the littoral zone, on every part of the coast. It is extremely variable.

Genus—BUCCINUM.

B. UNDATUM, Linn. (the "buckie.")

Very common, in all our laminarian and coralline zones. It varies to such an extraordinary extent that one can hardly realise that it is all one species. The solidity of the shell depends upon its environment, so that one may obtain a specimen from the rocks near low tide mark of a slatey colour, very solid, the mouth more than half the total length of the shell, and the outer lip slightly reflected and about quarter-of-an-inch in thickness; and then, take one from a sandy part of the coralline zone of a light buff colour, very thin, the mouth barely one-third the total length of the shell, the outer lip not reflected, and no thicker than parchment. The two preceding descriptions are from actual specimens.

Family—MURICIDÆ.

Genus—BUCCINORSIS.

B. DALEI, Sow.

Buccinum orum, Turt.

Rare: one specimen was dredged in October, 1897, forty-five miles E.N.E. of the River Tyne.

Genus—TROPHON.

T. TRUNCATUS, Ström.

Fusus clathratus, Linn.

Rather rare, from deep water.

Genus—FUSUS.

F. ANTIQVUS, Linn. (the common whelk).

Common, in all our coralline zones.

F. NORVEGICUS, Chem.

Common, from deep water everywhere.

F. TURTONI, Bean.

Rather rare, from deep water, off the River Tyne.

F. GRACILIS, Da Costa.

Not uncommon, in the coralline zone.

F. PROXIMUS, Ald.

Rather rare, from deep water.

F. BERNICIENSIS, King.

F. islandicus, Chem.

Rather rare, from deep water.

Family—NASSIDÆ.

Genus—NASSA.

N. INCRASSATA, *Ström.*

Common, on rocky ground, in the laminarian zone.

Family—PLEUROTOMIDÆ.

Genus—DEFRANCIA.

D. RETICULATA, var. FORMOSA, *Ren.*

Fusus barviciensis, *Johns.*

I have obtained only one specimen at Cullercoats.

Genus—PLEUROTOMA.

P. TURRICULA, *Mont.*

Fusus t., *Flem.*

Not uncommon, in all our coralline zones.

P. RUFa, *Mont.*

It is probably not uncommon, though I have obtained only one specimen from shell-sand at Cullercoats.

Family—CYPRAEIDÆ.

Genus—CYPRAEA.

C. EUROPAEA, *Mont.*

Common, in stony parts of the coralline zone.

Family—BULLIDÆ.

Genus—UTRICULUS.

U. TRUNCATULUS, *Brug.*

Bulla truncata, *Adams.*

Not uncommon, on muddy ground in the laminarian zone.

Genus—ACTÆON.

A. TORNATILIS, *Linn.*

Not uncommon, in deep sandy bays.

The Nudibranchs and Cephalopods have not yet been listed, but next year it is hoped the omission will be rectified.

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